

FY 2000 Report to Congress
of the
**Panel to Assess the Reliability, Safety,
and Security of the United States
Nuclear Stockpile**

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February 1, 2001

PANEL TO ASSESS THE RELIABILITY, SAFETY, AND
SECURITY OF THE UNITED STATES NUCLEAR STOCKPILE

February 1, 2001

The Honorable John W. Warner
Chairman
Senate Committee on Armed Services
U. S. Senate
228 Senate Russell Office Building
Washington DC 20510

Dear Mr. Chairman:

The Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile submits this FY 2000 report, in compliance with the Strom Thurmond National Defense Authorization Act of 1999.

Our work this year revealed growing deficiencies in the nuclear weapons production complex, deep morale and personnel problems, continued slippage of program milestones, and unacceptably high risks to the completion of needed weapon refurbishments. The declaratory policy that the nuclear stockpile is a supreme national interest in support of the nuclear deterrence strategy seems to us to dictate priority action to reverse these trends. Hence, there is an increasingly urgent need for a coherent vision, comprehensive plan, and programmatic commitment. Failure to meet these needs would virtually guarantee that, in the decades ahead, the nation would face a crisis in the weapons program.

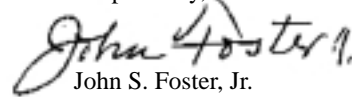
It is the Panel's view that major steps are needed to put the weapon program on a path that represents our best efforts toward sustaining confidence in the safety and reliability of the stockpile over the coming decades. Our report recommends action in nine areas.

Congress made valuable contributions last year when it created the National Nuclear Security Administration, restored Laboratory Directed Research and Development funding, and increased weapon program funding. The Panel believes that Congress can play additional vital roles this year in supporting implementation of the actions outlined in our report. The first is to work with NNSA to ensure the long-range plan, multi-year program, and budget for the weapons program are adequate. We are particularly concerned that funding shortfalls have caused the continual deferment of planned stockpile work, critical facility maintenance, and the scientific campaigns, and have undermined the sense of commitment and eroded confidence in the overall strategy. Once realistic plans and programs are established, we recommend that Congress give NNSA the flexibility it needs to manage execution of the program effectively. Second, NNSA will require substantial support from Congress as it takes the necessary steps to address gaps and deficiencies in the weapons production complex, and to strengthen the management of the weapons program within DOE and the NNSA.

Our review confirms the underlying strengths of the people in the national laboratory system and in the broader weapons complex. We have benefited from their full cooperation and support as well as from officials in the DOE and DoD. The actions we recommend would restore the sense of national commitment and effective top-level management that they deserve and require.

The Panel is in unanimous support of the report's recommendations.

Respectfully,



John S. Foster, Jr.
Chairman

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Chairman
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February 1, 2001

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EXECUTIVE SUMMARY

Congress established this Panel in 1999 to examine whether the United States can expect to sustain confidence in its nuclear deterrent while complying with the Comprehensive Test Ban Treaty.¹ This year we reviewed the national capability to perform the high priority, day-to-day work of stockpile stewardship – surveillance, assessments, refurbishment, annual certification, and production. We find a disturbing gap between the nation’s declaratory policy that maintenance of a safe and reliable nuclear stockpile is a supreme national interest and the actions taken to support this policy.

We are particularly concerned about the Department of Energy’s nuclear weapons production complex. Internal and independent reviews, including ours, find that after more than a decade of under-investment in the weapons complex, it is at unacceptably high risk to perform currently agreed upon weapon refurbishments, and it remains unready to fix nuclear component problems that may arise in years ahead. Throughout the broader complex the trends point downward because of the aging of facilities and the workforce. Morale is low, especially in the laboratories. Parts of the weapon complex infrastructure are defective; the production capabilities that remain are fragile. The Panel sees a growing need for a coherent vision, comprehensive plan, and programmatic commitment to reverse this situation.

Congress’ creation of the National Nuclear Security Administration (NNSA) provides the critical leadership opportunity to get the nuclear weapons program on a track consistent with the nation’s declaratory policy. This report describes the difficult challenges the NNSA, the Department of Energy, the Department of Defense, the Administration, and Congress together must address in the coming year.

Recommendations

A. Production complex -- Restore missing production capabilities and refurbish the production complex. The decline of the nuclear weapons production complex must be reversed with a 10-year program to eliminate critical maintenance backlogs and gaps in stockpile repair and replacement capabilities, requiring investment on the scale of \$300 to \$500 million per year. In addition, ongoing work on small-scale pit production capabilities and the certification of newly manufactured pits must be pursued with urgency. Work also must begin on the conceptual design of adequate nuclear facilities for the long-term support of the stockpile.

B. Design, production, and certification -- Stop the slippage in Stockpile Life Extension Programs and Production Readiness Campaigns that exercise the ability to design, fabricate, and certify replacement weapons. Current activities do not exercise end-to-end design, production and certification capabilities. Needed is a programmatic commitment for timely execution of planned Life Extension Programs (LEPs), coordinated with Production Readiness Campaigns that, together, exercise the full range of capabilities. It is imperative that these programs deliver products qualified for use in the stockpile. In addition, all three weapons laboratories should initiate work on the design of robust, alternative weapons that provide options for the future. These complementary activities contribute to training future weapon stewards.

¹ The 1999 Strom Thurmond Defense Appropriations Act created the Panel to review and assess (1) the annual process for certifying stockpile reliability and safety, (2) the long-term adequacy of that process, and (3) the adequacy of criteria to be provided by the Department of Energy for evaluating its science-based Stockpile Stewardship Program.

C. Surveillance -- Increase and enhance surveillance capabilities to predict and find defects in the stockpile. Surveillance is our first line of defense for maintaining high confidence in the safety and reliability of the stockpile. NNSA must create surveillance strategies to fit new circumstances. New stockpile sampling strategies need to be evaluated and implemented. New tools for non-destructive evaluation of nuclear components need to be developed and implemented promptly. Modest additional investments (\$10s of millions of funding per year) are needed.

D. Assessment tools and processes -- Stop the slippage in development of tools and processes needed to enable future assessments of stockpile safety and reliability. Timely execution of scientific campaigns is needed to assess the stockpile, and to transfer knowledge from test-experienced designers and engineers to the new generations of stewards.

E. Annual Certification Process -- Strengthen and broaden the Annual Certification Process. Progress is being made in strengthening this process. To provide a balanced perspective, the Certification Memorandum to the President should be broadened to report on the adequacy of facilities, people, tools, and methods for addressing future problems.

F. NNSA management -- Respond to morale issues at the labs, redefine laboratory missions, and address long-standing management concerns within DOE. Recent issues place the viability of our weapon laboratories at risk. NNSA should implement the recommendations of the Baker-Hamilton review to provide world-class science with needed security. NNSA also should redefine laboratory missions, making each responsible for all weapons in the stockpile, and fostering inter-lab intellectual competition. The NNSA Administrator must clarify functional authority, reduce management layers, eliminate micromanagement, and downsize.

G. Plans, programs, and budgets -- Implement a realistic plan, schedule, and multi-year budget for the Stockpile Stewardship Program, agreed to by the Nuclear Weapons Council. The new NNSA Future Years Plan (FYP) should provide, with the Defense Department's agreement, a realistic multi-year program to sustain confidence. Congress should support realistic budgets and provide NNSA flexibility to manage to this program. The Defense and Energy Departments should partner in a revised Nuclear Posture Review addressing the makeup of the future nuclear stockpile, and assessing DoD's requirements on NNSA to support that stockpile, including infrastructure and hedge strategies.

H. DoD's Roles -- The Department of Defense needs to become a more informed customer of the National Nuclear Security Administration. The DoD Nuclear Mission Management Plan must continue to be upgraded in order to provide a basis for program planning. Both NNSA and DoD must give stronger consideration to operational as well as technical solutions to nuclear weapons issues, including weapons security. The position of the Assistant to the Secretary of Defense (Nuclear and Chemical and Biological Defense Programs) must be enhanced to provide needed focus and leadership. The Defense Threat Reduction Agency (DTRA) must support its nuclear mission responsibilities with adequate budgets and programs to support DoD decision making.

I. Test readiness -- NNSA should determine the cost and feasibility of reducing the nuclear test response time to well below the Congressionally mandated one year. In the Panel's view, a policy of sustaining low levels of readiness could, in the future, tie the hands of a President faced with stockpile problems. Although the need to test is not imminent, it is prudent to seek affordable steps to reduce lead times for testing in order to provide future Presidents prompt, practicable options for sustaining confidence in the stockpile.

FY 2000 REPORT
of the
PANEL TO ASSESS THE RELIABILITY, SAFETY, AND SECURITY OF THE UNITED
STATES NUCLEAR STOCKPILE

INTRODUCTION

The Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile was created by Congress to review and assess (1) the annual process for certifying stockpile reliability and safety, (2) the long-term adequacy of that process, and (3) the adequacy of the criteria provided by the Department of Energy for evaluating its science-based Stockpile Stewardship Program. In carrying out our assignment, the Panel also strove to answer the question: Can the nation sustain sufficient confidence in the safety and reliability of its nuclear deterrence capability while complying with the terms of the Comprehensive Test Ban Treaty? Nuclear deterrence is a core element of the nation's declaratory security strategy, and sustaining confidence in deterrence capability will remain a supreme national interest in the decades ahead.¹ These fundamental commitments provide the benchmarks used by the Panel in our assessments of the policies, programs, and resources devoted to sustaining deterrence capabilities.

Confidence has always been a judgment – a determination that the nuclear stockpile will perform reliably to specifications and hence provide a credible deterrent capability. Sustaining confidence requires continued assurances of weapon safety and reliability based on painstaking surveillance along with quantitative and qualitative assessments of stockpiled weapons. It also requires trust in the people, tools, and methods used to find, assess, and fix problems in the stockpile. This trust today relies heavily on experienced weapon designers, scientists, engineers, and production personnel, as well as the extensive test database for existing weapons. The skepticism, diligence, and perseverance of today's stockpile stewards

¹ This commitment was underscored in the President's statement on the proposed Comprehensive Test Ban Treaty: "The U.S. regards continued high confidence in the safety and reliability of its nuclear weapons stockpile as a matter affecting the 'supreme interests of the country'... ." William J. Clinton, Letter of Transmittal (Comprehensive Nuclear Test Ban Treaty), The White House, September 22, 1997. This commitment was also central in the Senate's advice and consent to the START II Treaty – "The Senate declares that the United States is committed to ensuring the safety, reliability, and performance of its nuclear forces..." Resolution of Ratification, January 26, 1996, (c) *Declarations* (12).

have been sharpened by the surprises they have encountered through nuclear testing and other experiments. Their experience and resulting attitudes reinforce the trust that national leaders place in their assurances that the stockpile is safe and reliable.

In the absence of new weapons production and underground nuclear testing, the strategy for sustaining confidence in the future is based on the Stockpile Stewardship Program (SSP) and the Annual Certification Process (ACP). Over the long run, this strategy poses significant technical challenges. Aging and unavoidable changes are already introducing uncertainties regarding component and system performance. As time passes, uncertainties inevitably will grow until, unless adequate new knowledge is gained through the Stockpile Stewardship Program. Sustaining confidence requires that we improve our understanding of weapons and our assessment capabilities faster than new uncertainties enter the stockpile, and before most of the experienced personnel are lost.² It is *paramount* that stewardship and annual certification embody mechanisms that guard against the onset of complacency, and that they engage the nation's best scientific and engineering talent in well-structured efforts to sustain confidence in stockpile safety and reliability.

In last year's Report, the Panel advocated five supporting elements for stewardship, which together form the management and programmatic foundation to execute the Stockpile Stewardship Program. These are:

- talented, well-trained people
- adequate weapons complex diagnostic and manufacturing capabilities
- a sound base of knowledge (scientific understanding)
- effective and integrated management structures
- national commitment to a robust program of hands-on, innovative work.

² Confidence reflects quantitative and qualitative assessments of weapon system reliability and safety. Quantitative assessments of the non-nuclear components have been obtained through extensive production and surveillance testing. Qualitative assessments of the nuclear subsystem have been based on the judgments of the nuclear design laboratories, supported by data from the original weapon development program, underground nuclear testing, and non-functional surveillance tests and inspections. The small number of relevant underground tests of the nuclear subsystem (primary and secondary) has not provided a credible statistical basis for the nuclear design laboratories to provide quantitative assessments for these components. Nevertheless, high levels of confidence resulted when nuclear test results were consistent with experience, basic scientific understanding, and the results from models and calculations. Confidence also was reinforced by the track records of the people, tools and methods employed in developing or modifying weapons.

In formal reliability reports, the nuclear components have always been judged to be 100 percent reliable, so reported weapon reliability is equivalent to the estimated reliability of the non-nuclear components up to the point of detonation. Reported reliability thus does not capture any uncertainties in the judgement of nuclear component reliability; failing to understand this can result in misplaced confidence. Looking to the future, as changes in the nuclear subsystem are introduced or occur naturally, confidence will require a better understanding of the uncertainties inherent in these assessments

In the absence of nuclear testing, the challenge for the Stockpile Stewardship Program is to provide objective scientific evidence to support confidence in future judgments. The challenge for the Annual Certification Process is to accurately convey the level of confidence to the President.

We outlined initial observations in each of these areas and offered several specific recommendations for actions we believed needed immediate attention. We proposed greater budget priority to begin work on the conceptual design of an adequate nuclear pit production facility, accelerate the archiving and preservation of legacy data, step up work on more robust weapon designs, and strengthen weapon surveillance activities.

The Panel also offered recommendations for strengthening and broadening the Annual Certification Process.³ In the Panel's view, the Annual Certification Process should scrub the assumptions and data used in the surveillance and assessment of each weapon, and then provide an assessment of the degree of confidence national leaders can expect to have in the safety and reliability of the nuclear stockpile. Ultimately, the President must decide whether confidence is acceptable.

This FY 2000 report provides additional observations based on our ongoing assessments of the Stockpile Stewardship Program and the Annual Certification Process. Congress took a major step this year, when it created the National Nuclear Security Administration (NNSA). We recommend nine complementary actions that we believe would set the weapons program on a course that will continue to support the national nuclear deterrence strategy over the decades ahead. Based on our initial interactions with the Administrator, we know the NNSA is initiating or planning efforts in many of these areas. We will observe NNSA's efforts in the final year of our commission.

³ The Annual Certification Process is the reporting process established as a result of President Clinton's statements on August 11, 1995 announcing the safeguards associated with the proposed "zero yield" comprehensive test ban: "As part of this arrangement, I am today directing the establishment of a new annual reporting and certification requirement that will ensure our nuclear weapons remain safe and reliable under a comprehensive test ban." As detailed in Appendix A of the Panel's FY1999 Report, the Annual Certification Process entails a review of the reliability and safety of the stockpile by the laboratory directors, the Commander of the Strategic Command, and the Secretaries of Defense and Energy in order to advise the president as to whether there are problems in the stockpile requiring a return to underground testing.

OBSERVATIONS

The Panel sees modest accomplishments within a declining weapons complex

This year, the Panel expanded its review to include the nuclear weapons production complex. We also observed the Annual Certification Process, revisited the three weapon laboratories, reviewed progress with the Stockpile Stewardship Program, and monitored work on our recommendations. Over the course of this past year, we have found that:

- The production complex is meeting some of the current, albeit modest, demands placed on it. However, the deteriorated complex has not been able to keep even these modest efforts on schedule.⁴ Examples of accomplishments include:
 - Progress with the W87 (Peacekeeper warhead) Life Extension Program
 - Ongoing dismantlement, surveillance, and weapon maintenance activities
- Progress is being made with the Stockpile Stewardship Program, including:
 - Completion of the W76 (Trident warhead) Dual Revalidation
 - Fabrication of the sixth development pit at the Los Alamos small-scale pit production facility
 - Achievement of a three-dimensional burn simulation milestone in the Accelerated Strategic Computing Initiative (ASCI) program
 - Definition of criteria for stewardship tools (as required by Congress)
 - Management initiatives to improve planning (i.e. the “Greenbook”), reform the budget structure, assess production capabilities, and enhance quality and efficiency throughout the complex

⁴ The DOE Inspector General found that “...the Department, in 1999, was not able to meet the initial modification and remanufacture activities for the W87 weapon system due, in part, to delays in scheduled infrastructure maintenance. We found that half of the bays dedicated to modification and remanufacturing in a Pantex facility were being upgraded for fire safety, lightning, and radiation protection. The upgrade construction project was first submitted to the Department in Fiscal Year 1988. Work did not begin until 1994 and was in progress during 1999. This was the same year that the W87 effort was to begin. We were advised that the Fiscal Year 1999 modification and remanufacture activities for the W87 would not be completed until at least Fiscal Year 2002... NNSA officials advised that other factors also contributed to the weapons schedule delays. For example, technicians needed training on the W87 modifications. Furthermore, other weapon system activities converged on the Pantex facility at the same time.”

Again in 1999, only two-thirds of scheduled dismantlements of retired weapons could be completed, again due to infrastructure problems. The Y-12 facility has not yet re-established the process capability and capacity needed for the W76 life extension. *Audit Report. Management of the Nuclear Weapons Production Infrastructure.* U.S. Department of Energy. Office of Inspector General. Office of Audit Services. DOE/IG-0484. September 2000, p. 4.

- The Secretaries of Defense and Energy have continued to certify that the stockpile is safe and reliable:
 - The laboratories, the U.S. Commander in Chief, Strategic Command and his Stockpile Assessment Team (SAT), and Department of Energy (DOE) headquarters are strengthening surveillance, assessment, and annual certification processes in response to the Panel's recommendations.

But the Panel also sees troubling signs of decline within the national laboratories and the weapons production complex. In the laboratories, we saw increasing frustrations as commitments to stockpile work and SSP milestones have been allowed to slip. We witnessed, first hand, the shock of scientists and engineers over the serious and highly publicized security breaches, followed by wide-reaching recriminations and criminal investigations. Laboratory scientists and engineers are highly dedicated to their mission, but many find the work environment becoming unacceptable. The rate of departure is up significantly at all three laboratories this year; acceptance of job offers is down; and for the first time the laboratories are losing some of their most dedicated mid-career staff.

The Panel also visited some of the forty- and fifty-year old production facilities at the Pantex, Oak Ridge Y-12, and Kansas City plants where weapons work is being done with aged equipment, employing health and safety practices that have been grafted onto the work flows of these outmoded facilities. Only a very small amount of design and production work is actually being performed. For at least a decade, these facilities have been permitted to spend only the minimal amounts needed to sustain operations for the tasks at hand. Consequently, independent DOE and DoD studies that find the production complex is incapable of meeting future stockpile requirements.⁵ In the coming decade, some \$3 to \$5 billion will be needed to remedy this situation. The DOE reports a maintenance backlog of \$700 to \$800 million. Additionally, there is a need for \$300 to \$500 million per year for up to ten years for recapitalization to restore the capability to meet workloads.

In addition to these shortfalls, there remain troubling gaps in production capabilities for nuclear components. Almost a decade after the shutdown of the Rocky Flats plant, there still is no capability to fabricate qualified pits. DOE has been working on a small-scale production facility at Los Alamos, and currently predicts it will provide the first qualifiable pit in FY 03.⁶ Last year, in its most important recommendation, the Panel recommended that DOE begin the conceptual design of an adequate, full-scale production facility to meet long-term stockpile requirements. Conceptual design is the first small, and relatively inexpensive, step in a likely fifteen-year project. DOE continues to study this problem, but has postponed implementing a solution. In the FY01 budget, Congress provided initial, low-level funding to start the conceptual design, even though DOE did not include a request in its budget.

⁵ The Panel met with facility managers three times on the status of production facilities at Y-12, Pantex, Kansas City Plant, Los Alamos National Laboratory, and Sandia National Laboratories. The Panel also was briefed on reviews performed by DoD's Program Analysis and Evaluation office, and the DOE Production Readiness Assessment. The findings of these reviews were confirmed in a DOE Inspector General's Report: Audit Report. Management of the Nuclear Weapons Production Infrastructure, September 2000, DOE/IG-0484.

⁶ DOE defines warhead "certification" as the determination that a warhead meets military characteristics, stockpile to target sequence performance and survivability requirements. "Qualification" is the acceptance of a new or modified component for use in the stockpile.

With respect to secondary production at Y-12, the Panel was told that funding has not been available to re-establish facilities shut down in 1994 for safety and health reasons. These facilities are needed to process required special nuclear materials. Lacking these capabilities, Y-12 has accumulated and stored the wastes from its ongoing work for the last six years. DOE estimates that restoring full capability will require at least eight years. It reports that it has recently implemented leadership changes in the contractor and federal organizations at Y-12 and is placing high priority on reestablishing necessary operations.

In summary, production managers across the complex describe their situation as an impending disaster. They warn that the current approach is pushing their facilities toward failure, and that the current program does not enable them to hire and train a new generation of workers.

The Panel finds that the state of the weapons complex is deficient in some critical areas and fragile in many others, and we have not seen the programmatic commitment needed to turn this situation around. In our view, the failure to reverse the downward spiral in the laboratories and production complex is unacceptable. Evidence of worrisome deterioration in nuclear components has already been found. Moreover, the history of the stockpile has demonstrated many surprises, and weapons are entering an age regime for which we have no prior experience. We believe the need to design, fabricate, and qualify new components will increase. At the same time, we see a declining capability to produce and qualify replacement components, and confidence is declining in our capability to design, fabricate, and certify modified weapons.

The National Nuclear Security Administration (NNSA) inherits major challenges

Congress took some essential steps toward addressing the problems in the weapons program last year when it established the National Nuclear Security Administration (NNSA) and provided an increase in funding for the weapons program. Creation of the NNSA provides an opportunity to strengthen top management focus on the nuclear program within DOE, and should serve to foster the development of integrated plans, programs, and budgets. It should also provide a span of control that permits the integration of the weapons program with related functions such as health, safety, and security. This Panel is encouraged by the actions of Congress, and by the steps taken in establishing the NNSA.

But, as we observed above, the NNSA inherits serious challenges in stemming the adverse trends across the weapons complex. The funds requested and appropriated for FY01 relieved some of the immediate pressure on the program, but this increase in funding will not reverse the decline. The program needs a coherent strategy, and adequately scoped and funded programs focused on sustaining confidence in the stockpile. The new strategy must reflect a long-term commitment to the nuclear deterrent, and a balanced focus on near- and long-term needs. In our view, this entails:

- restoring integrated design and production capabilities,
- timely development of the knowledge base, tools, and methods needed to assess stockpile reliability and safety in the decades ahead,
- realistic plans, programs, and budgets focused on sustaining confidence,
- strengthened DOE and DoD management for nuclear matters, and
- a viable test readiness posture.

The Panel's recommendations provide an agenda addressing these needs.

We trust that the Administrator of the NNSA will take the lead in implementing this approach — but the NNSA cannot do this job alone. The Panel urges the Secretaries of Energy and Defense, the President, and the Congress to support NNSA in putting the weapons program on a course toward successful execution of the Stockpile Stewardship Program.

RECOMMENDATIONS

The recommendations in this section focus on the critical challenges the NNSA, the Departments of Defense and Energy, the White House, and the Congress must address in the coming year. The Panel is unanimously of the view that the steps outlined here are essential to begin to reverse the adverse trends in the weapons program.

A. PRODUCTION COMPLEX

Restore missing production capabilities and refurbish the production complex

Our observations in the preceding section describe the troubling state of the nuclear weapons production complex. The United States remains unable to produce new weapons or reproduce all of the components in the existing inventory.

Despite the critical role that weapons production capabilities will play in sustaining confidence, no sense of urgency has characterized the DOE's actions to manage the weapons complex.

This and the following recommendation outline the actions necessary to restore integrated design, fabrication, and qualification capabilities for the full range of weapon components. In this section we outline a three-track program for restoring the production facilities. The next section describes the program of work necessary to establish and sustain the capability to perform work within the facilities. These efforts should be aimed at restoring capabilities over the next ten years.

The need to modernize the production complex has been recognized for more than a decade. DOE published its "Complex 21 Study" in 1991, which described the improvements deemed necessary at that time. With the precipitous end of the Cold War, these plans were never implemented. Since then, the lack of long-term policy guidance contributed to planning paralysis, while the infrastructure continued to deteriorate. As we discuss in Recommendation G, the 2001 Nuclear Posture Review provides a critical opportunity to reverse the situation and illuminate the road ahead.

1. Restore the capability to support needed weapons work

Managers within the complex are concerned that the deterioration of the physical facilities is accelerating. For some of these deteriorated 40 to 50 year-old facilities, it is now questionable whether renovation is warranted; it may be more cost-effective to build replacement capabilities. Yet, there is no agreed upon plan or program in place for addressing the complex-wide backlog of critical maintenance requirements. The NNSA must take the lead in defining a long-term program for reversing these trends.

The first essential step is to restore the capabilities needed to perform the stockpile work that will need to be accomplished in this decade. This includes ongoing surveillance,

maintenance, and limited life component exchanges. As discussed in the next section, it also include execution of the planned life extension programs for the W80, W76, and B61 weapons, work associated with production readiness campaigns, and any work needed to support alternative warhead designs. NNSA must:

- Plan and execute a ten-year program to restore needed production capabilities. The DOE reports a maintenance backlog of some \$700-\$800M. Additionally, there is a need for \$300-\$500M/yr for some ten years for recapitalization to ensure that the production complex will be able to meet both current and future workloads.
- Complete the small-scale production facility for pits at Los Alamos, qualify the new production pits, and certify the W88 warheads that contain the newly manufactured pits.

Completing the program at Los Alamos to provide a small-scale pit production capability is essential for capturing the unique skills and technologies needed to produce pits for the W88 and other weapons in the enduring stockpile. These are core competencies we must recover. It also provides a critical test case of the capability to qualify new nuclear components and to certify weapons containing such components without underground nuclear testing. In October, 2000, Los Alamos National Laboratory completed a draft “W88 Pit Manufacturing and Certification Integrated Project Plan” and a final report is scheduled for completion prior to submission of the FY 02 budget. The Panel will review this plan. In addition to addressing technical uncertainties, this plan should give consideration to process issues such as: what will be the role of inter-laboratory review; and what processes will be in place to resolve disagreements about certification? The quality of decision making will be enhanced if such issues are considered and criteria approved before this decision has to be made.

2. Restore nuclear facilities adequate to long-term needs

The nation must be prepared to address problems that may arise in the nuclear components of stockpiled weapons. NNSA should begin a time-phased program to design and build the critical nuclear facilities needed to have a complete capability to produce and refurbish nuclear components. These include facilities for pit production, secondary production, and some upgrades at the nuclear laboratories.

Work on the conceptual design of these facilities can begin without a large financial commitment—on the order of tens of millions of dollars per year initially. As a planning target, conceptual design work should aim toward a possible go-ahead decision on facility construction in about four years. This would enable the necessary decisions to establish an up-to-date, appropriately sized production complex within the next ten years. This is a demanding planning target: DOE has estimated it would take fifteen years to design and build a new pit production facility. Nevertheless, we believe a faster rate of progress should be sought, because ten more years without the capability to produce adequate numbers of nuclear components is pushing the limits of acceptable risk.

3. Design and production process improvements

NNSA should adopt the “Six-Sigma” design and production philosophy throughout the weapons complex.⁷ Such quality programs focus on designing, analyzing, and monitoring processes with the goal of virtually eliminating defects and errors. This philosophy has demonstrated benefits in improving design, manufacturing, logistics, and business processes. Adopting this philosophy in the design and manufacturing of new weapon components would reduce the likelihood of “birth-defects” entering the stockpile as components are replaced, and thus improve confidence.

A valuable test case of the application of this philosophy is presented by Sandia’s efforts to improve its processes for designing and qualifying new components. Sandia’s new approach, briefed to the Panel, should provide demonstrable improvements in terms of defect-free manufacturing and reliability. These can be measured as reductions in test, part acceptance, and field failures. Sandia’s efforts provide an opportunity for a useful controlled experiment for improving weapon development practices: Quantitative assessment of this experience should provide lessons for the other two nuclear laboratories as well as for future Sandia programs.

Six Sigma methods have been in use at the DOE Kansas City Plant (KCP). NNSA is taking advantage of its demonstrated expertise by having KCP perform a significant role in adopting “Six Sigma” methods throughout the complex.

B. DESIGN, PRODUCTION, AND CERTIFICATION

Stop the slippage in Life Extension Programs and Production Readiness Campaigns that exercise the capability to design, fabricate, and certify replacement warheads

The 1994 Nuclear Posture Review requires DOE to:

Maintain [the] capability to design, fabricate, and certify new warheads, (and)

Demonstrate [the] capability to refabricate and certify weapon types in [the] enduring stockpile.⁸

This policy is reinforced in the Resolution of

Ratification for the START II Treaty:

(A) The United States is committed to proceeding with a robust stockpile stewardship program, and to maintaining nuclear weapon production capabilities and capacities, that will ensure the safety, reliability, and performance of the United States nuclear arsenal at the START II levels and meet requirements for hedging against possible international developments or technical problems in conformance with United States policies and to underpin deterrence.

⁷ Six Sigma is a management framework developed by the Motorola Corporation; it has also been applied by General Electric, Xerox, Honeywell, and other leading corporations. It is a quantitative approach for defining, understanding, and controlling business processes that yields significant cost savings and product improvements. Honeywell is applying it in the Kansas City Plant.

⁸ *Nuclear Posture Review*, briefing format report, 1994, p. 27.

(B) The United States is committed to re-establishing and maintaining sufficient levels of production to support requirements for the safety, reliability, and performance of United States nuclear weapons and demonstrate and sustain production capabilities and capacities.⁹

These objectives have not been achieved, yet they are vital for the long-term success of stockpile stewardship. The simplest and most effective way to re-establish this end-to-end capability is through work programs that exercise all facets of it.

Three programs of work are defined in this section. Managed in coordination, these programs would fully exercise the restored weapons complex, and provide some assurance that the critical end-to-end capabilities needed for design, fabrication, and certification will be exercised and sustained. To ensure the most effective results, DoD and DOE must develop, through the Nuclear Weapons Council, an integrated assessment of the impact of planned work on the weapons complex. The recent DOE Production Readiness Assessment briefed to the Panel provides a good starting point for this.

1. Define and begin performing the weapons work that will be necessary in this decade

DOE's current program of weapons work combines 1) planned weapon life extension, maintenance, and limited life component exchange activities, and 2) ongoing surveillance and assessments that are designed to "find and fix" problems in the stockpile. This combination of planned work with "find and fix" work is essential not only for its contribution to sustaining confidence in the stockpile over the long run but also for generating the hands-on work necessary for maintaining capabilities within the weapons complex.

Life Extension Programs (LEPs) are weapon-type-specific refurbishment and modernization activities for weapons in the enduring stockpile. DoD and DOE, through the Nuclear Weapons Council, agree to LEP requirements, including the scope and schedule for each LEP. The Panel is concerned that, because commitments to life extension work had been continually postponed, the complex has not had sufficient end-to-end work to sustain needed capabilities. Late in calendar year 2000, the Nuclear Weapons Council approved plans to begin LEP programs for the life extension of the W80 (cruise missile warhead) and W76 (Trident warhead).

Programmatic commitment to the timely execution of these programs is essential, and will contribute greatly to sustaining needed weapons complex capabilities. It is important that the laboratories be engaged in significant engineering development activities.

2. Production Readiness Campaigns

The Production Readiness Campaigns are the elements of the Stockpile Stewardship Program created to sustain, develop, or restore capabilities needed for developing and

⁹ United States Senate, *Resolution of Ratification*, January 26, 1996. *Congressional Record*, S461-S463

fabricating replacement components for stockpiled weapons.¹⁰ If appropriately coordinated, the Production Readiness Campaigns would focus on those capabilities that are not sustained by planned stockpile work. To be effective, these Campaigns must include component-scale manufacturing with throughput and products qualified for the stockpile. This provides a necessary discipline to discriminate between intention and accomplishment.

3. Design of robust, alternative warheads

In our first report, this Panel recommended that, as a hedge against future uncertainties, the Stockpile Stewardship Program include the design of robust replacement warheads for some of the key weapons in the current inventory. Ongoing design work is essential to support the declaratory policy that sustaining the capability to design and field new weapon types is integral to SSP.¹¹ A successful example of this concept is presented by the Submarine-Launched Ballistic Missile Warhead Protection Program, in which the nuclear weapon laboratories and the Navy explored warhead options. Nothing in the Comprehensive Test Ban Treaty (CTBT) prohibits work on such designs.¹²

The availability of such designs provides an essential hedge against future uncertainty. The Panel is concerned that some current enduring stockpile weapon designs are so highly optimized for weight, yield, and material usage that they provide very thin performance margins. These designs are fussy, and testing has revealed inconsistencies that are not understood. Ten or twenty years from now, the performance of these weapons may no longer be resilient to the inevitable changes in materials and components that will occur. At such time we may have more confidence in weapons based on conservative versions of previously tested designs, than we would have in modified versions of the enduring stockpile weapons.

The Panel believes a program for design of more robust, alternative warheads should continue on an ongoing basis, and that new challenges should be undertaken while test-experienced designers are still available to provide their unique expertise. This would provide opportunities for the next-generation weapons stewards to learn under the tutelage of test-qualified designers.

¹⁰ These Campaigns are Pit Readiness, Secondary Readiness, High Explosive Manufacturing, Weapon Assembly/Disassembly, Nonnuclear Readiness, Tritium Readiness, Materials Readiness, Advanced Design and Production Technologies, and Enhanced Surety.

¹¹ The policy was recently restated in answers to advance questions to Ms. Madelyn R. Creedon from the Committee on Armed Services, United States Senate. "...The ability to design and field new weapons types, however, is, appropriately, an integral part of the stockpile stewardship program." April 11, 2000, p. 8.

¹² "The United States understands that Article I, paragraph 1 does not prohibit any activities not involving nuclear explosions that are required to maintain the safety, security, and reliability of the U.S. nuclear stockpile, to include: design, development, production..." U.S. Department of State, *Article-by-Article Analysis of the Comprehensive Nuclear Test-Ban Treaty, Article I — Basic Obligations*, p. 3.

C. SURVEILLANCE

Increase and enhance surveillance capabilities to predict and find defects in the stockpile

This Panel has repeatedly said that the only way we can hope to sustain confidence in the stockpile is to be convinced that every effort is being made to find any problems that may exist. If, after an exhaustive look, no major problems are found,

then we are as confident as we can hope to be, absent nuclear tests. To counter any tendency to *assume* confidence, the tools, people, and methods involved must rigorously question the continued certifiability of the stockpile. In this, and the following two recommendations, the Panel provides recommendations for strengthening each of the three phases of this activity: surveillance, assessments, and the Annual Certification Process.

Stockpile surveillance is the linchpin: it includes the annual disassembly and inspections of samples of each weapon type, laboratory testing of components, and flight testing of weapon systems. The raw data from surveillance constitute the leading edge for determining the changes in, and ultimately the health of, the stockpile.

The Panel is encouraged that DOE and the weapons complex have been responsive to our specific concerns and suggestions to strengthen surveillance, as well as to those of the STRATCOM Stockpile Assessment Team (SAT). For example, backlogs in surveillance activities have been reduced. Improved surveillance methods are being developed. Independent review of surveillance activities has been strengthened by the SAT, as well as by the laboratories. We continue to be impressed with the quality and diligence of the people engaged in this process. We also see some progress in the field of weapon forensics, which is the process of detecting and tracking down root causes of problems in design or production so that these can be fixed or avoided.

The Panel nevertheless believes that more should be done. The laboratories and DOE officials briefed the Panel on options to improve the strategies for surveillance and to expand the data collected with nondestructive surveillance. Every effort should be made to implement these new approaches. Surveillance is not expensive compared to the overall SSP, so the Panel sees no reason to do anything but the best possible job.

1. Risk management strategy and tailored surveillance programs

The laboratories have briefed the Panel on their initial development of metrics for weapon certification. The Panel is encouraged by this work, and sees it as a basis for defining systematic risk management strategies and surveillance programs tailored to the needs of each weapon type.

Risk management should be founded on a culture that questions, rather than accepts, the data and the assumptions used to assess safety and reliability. Basing the risk management strategy on a periodic “Devil’s Advocate” review of each weapon is one way to foster the needed culture of skepticism. For example, each laboratory could form an independent review team of laboratory and external experts in relevant fields that would focus on the question: “Why will the generic bomb (B_{xx}) or warhead (W_{xx}) fail?” The teams are not asked whether they believe the weapon will fail, but to assess and document all the ways it believes

the weapon could fail, looking a decade into the future. Asking this question can serve to guard against the onset of complacency. Answering the question will stimulate the imagination of the participants and spark intellectual debate on possible failure modes in the stockpile.

The review process entails three phases. First, the independent review teams would examine archived data on the B_{xx}/W_{xx} and relevant weapons, assess design margins, assess deviations from design specifications, assess weapon certification metrics, and factor in the results of stockpile stewardship and enhanced surveillance efforts.¹³ Second, the teams would develop a list of potential issues that should be considered in the surveillance, assessment, and annual certification of the B_{xx}/W_{xx} . Designers and engineers in each of the laboratories would assess these issues, draw conclusions as to their significance, and outline the appropriate responses. There must be funding made available to permit the prompt investigation of any serious issues identified through this process. Third, the individual reports on this work would be reviewed by the NNSA.

The product of this work would be the development of (or revisions to) a B_{xx}/W_{xx} surveillance program. The program would include goals, milestones, and funding profiles. Alternative approaches may target sampling of those units which are representative of the most important weapons in the stockpile and which are more likely to be leading indicators of failure. The risk management strategy must include plans and capabilities for accelerating the collection of data across the stockpile whenever a problem is discovered. It would also consider potential improvements in the tools for surveillance, as discussed below. The surveillance program would be developed by a team under the leadership of the government official responsible for the B_{xx}/W_{xx} surveillance program, based on the findings of the independent review. To assure the program is thoroughly scrubbed and vetted, it is recommended that the laboratories and the STRATCOM's Stockpile Assessment Team review it.

One important benefit of a process such as this is that it would provide a forum for issues or questions regarding the stockpile to be addressed systematically, and provide a mechanism for causing needed actions to be incorporated in surveillance and assessment activities. When a question regarding a potential failure mode is raised, the current system too often finds reasons why it should not, or cannot run the problem to ground. The Panel finds this behavior to be unacceptable.

2. Participation of laboratory designers and engineers in surveillance

One of the intangibles lost with the foreclosure of new production and testing is that designers do not engage in the full range of design responsibilities. In recent years, the interaction between labs and plants has improved, with better-defined interfaces and more frequent communication. Nevertheless, it would be beneficial for nuclear laboratory personnel to be more intimately and personally involved in weapon surveillance, particularly at Pantex and Y-12. We recognize that the

¹³ Ideally, the "Devil's Advocate" review should be performed as an element of the periodic "Dual Revalidation" of weapon design assumptions, test data, and simulation codes. But as discussed below, DOE currently does not plan any future Dual Revalidation programs.

nature of the benefits is unpredictable, but it is essential to provide laboratory scientists and engineers every opportunity to be challenged and surprised.

3. Surveillance tools

The NNSA should aggressively exploit available new surveillance tools and methods. Improved metrology of aged weapon samples is a simple yet effective means of assessing changes that will likely be seen as the current stockpile ages. In addition, techniques for accelerating the aging process of explosive and nuclear materials are needed in order to explore beyond the limits of available naturally aged materials. Diagnostic technologies such as improved x-ray tomography, neutron imaging, and in-situ chemical analysis need to be brought on-line. Material properties data need to be accumulated, through the use of laboratory-based diagnostic equipment and sub-critical experiments at the Nevada Test Site. Unfortunately, a number of these initiatives are behind schedule.

The Panel is particularly concerned with reports on the slow progress being made in installing new radiographic technologies at Pantex. Given the signs of deterioration in some nuclear components we noted earlier, it is essential to obtain these non-invasive tools to find out how widely such deterioration is to be found in the stockpile.

The lack of progress in deploying advanced surveillance tools is more a lack of management focus than it is a lack of available funding. Compared to the other major initiatives discussed in this report, these are quite inexpensive. The surveillance program should include milestones and funding streams to quickly deploy valuable new surveillance capabilities.

D. ASSESSMENT TOOLS AND METHODS

Stop the slippage in development of tools and processes needed to enable future assessments of stockpile safety and reliability

There is general agreement among those having direct stockpile responsibilities that existing assessment tools and the current level of scientific understanding are inadequate to provide sufficient confidence in either a future aged stockpile or a newly manufactured replacement, without nuclear testing. A central focus of the Stockpile Stewardship

Program is to develop the new scientific and engineering tools needed to augment the understanding of nuclear weapon performance and to provide the best possible chance of sustaining confidence. We are nevertheless concerned that most of the accomplishments of the first five years of SSP have been made on an *ad hoc* basis, in the sense that we have not seen programmatic implementation of plans to develop needed stockpile tools.

In an attempt to create such framework, and to assess program progress, Congress put forth, in the Strom Thurmond National Defense Authorization Act of 1999, a requirement for DOE to assess information needs for stewardship and to develop criteria for the evaluation of the tools that are being developed to meet those needs. The Department of Energy responded this year with the publication of its "Criteria for Stockpile Stewardship Tools." Taken together with the "Stockpile

Stewardship Program Plan for FY2001” (also known as the Green Book), DOE has described its expectations regarding the performance of the stewardship tools.

In the 1999 Authorization law, Congress required this Panel to assess the DOE report. In brief, we find that:

- The Department has made a reasonable effort to describe the weapon physics and performance areas where knowledge is currently incomplete and to describe the kinds of tools necessary to progress toward obtaining this knowledge.
- Specific criteria defining the needed tools have not been developed in some areas, a fact that by itself is not particularly troubling given the degree of uncertainty in this program. However, the lack of a defined process or timetable to reach closure and assess progress is reason for concern. DOE met the Congressional mandate on a one-time basis; the Panel believes an ongoing process is needed.
- The current DOE budget does not reflect stated needs, and the lack of a future years program prevents any judgment on the feasibility of developing the tools described in DOE’s report to Congress. In order to assure the timely development of needed capabilities, NNSA must develop its Stockpile Stewardship Plans into a future-year program that links information needs, technical performance criteria, and Campaign milestones with resource requirements.

Congress, in the Defense Authorization Act of 2000, instituted the requirement that NNSA employ the Criteria in defining its requirements and milestones, and use these as the basis for its planning, programming, and budgeting processes.¹⁴ Absent a process to complete and update the criteria, they do not suffice to meet this new requirement.

To accomplish the needed linkage between technical and resource requirements over time, the milestones for stewardship campaigns must be linked with the needs of the Stockpile Stewardship Program. We see three important time scales:

- First, in the short term, emergencies can happen, such as a surveillance finding, a change in the international situation, or a technological “surprise.” On this time scale, existing tools have proven adequate to date to meet stockpile needs; e.g., certification of the W87 as part of its warhead life extension program. The essential capabilities needed in the short term are a functioning production complex and an experienced staff who can make judgments on weapons performance.
- Second, we know that deterioration of nuclear packages is occurring, but the time scale is uncertain. Existing tools have been used to assess the impact of aging effects in nuclear packages and similarly these tools will be essential to certify

¹⁴ “The Administrator [NNSA] shall include in the materials the Administrator submits to Congress in support of the budget for any fiscal year that is submitted by the President pursuant to section 1105 of title 31, United States Code, a description of how the funds identified for each program element in the weapons activities budget of the Administration for such fiscal year will help ensure that the nuclear weapons stockpile is safe and reliable as determined in accordance with the criteria established under 3158 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (Public Law 105-261; 112 Sta. 2257; 42 U.S.C. 2121 note).

newly produced nuclear components. New tools must be acquired in time to address future assessment challenges.

- A third time scale is associated with the transition between generations of stockpile stewards. Over ten to twenty years, capabilities can be lost, standards can deteriorate, and institutions can atrophy, unless renewal is planned for, fostered, and embraced. The need to engage, mentor, and challenge the next generation of weapon designers, engineers, and producers is at hand. Already a significant number of weapon designers do not have nuclear test experience. The Campaigns and their implementation programs must reflect the vital role of the stewardship tools in developing essential workforce expertise.

In sum, tools must be developed before experienced personnel leave and before the aging process causes significant deterioration of the stockpile. A careful assessment of the critical stockpile risks should guide the milestones for developing the stewardship tools. Any plan that defers the needed tools beyond the working life of test-experienced designers is inherently flawed.

The remainder of this section addresses five major categories of stewardship tools: Surveillance, Inertial Confinement Fusion, Advanced Radiography, the Accelerated Strategic Computing Initiative, and stockpile data archives.

Surveillance Tools: The Enhanced Surveillance Campaign focuses on the development of tools to advance the ongoing surveillance of the stockpile to a more complete and predictive assessment of the stockpile. (The need for timely development of these tools is discussed earlier in the previous section on Surveillance.)

Inertial Confinement Fusion: The National Ignition Facility (NIF) is the next logical step in a basic research program in high-energy density physics that has been conducted until recently at the NOVA laser facility.

We have not examined the technical and programmatic problems associated with the development and construction of this facility, which have received national attention. We have, however, received briefings and documentation concerning the relevance and importance of NIF to stockpile stewardship. We are convinced that NIF could offer critical insights into stewardship problems that are inaccessible otherwise. In the FY01 Defense Authorization Act, Congress required a review of the NIF program and problems. We offer a few observations that we believe are important and relevant:

- It is very important that the NIF produce ignition in order to address a new range of stockpile issues, but ignition is not assured even for a full-power NIF. The subset of issues that could be addressed short of ignition is also important, but a half-power NIF without ignition is not worth the investment for stockpile stewardship. We believe that ignition should be the prime stated goal.
- Unclassified research also is important, but must not be to the detriment of stockpile stewardship. The capability and schedule must be driven by stewardship needs. Outside users are beneficial to the laboratories' scientific environment, to the continued excellence of the laboratories' basic research program, and are potential contributors to stewardship. The continued excellence of the nuclear

laboratories' basic research programs and the capability to sustain confidence in the stockpile are certainly linked. However, stockpile stewardship needs should have first priority.

Advanced Radiography: The Dual Axis Radiographic Hydrotest (DARHT) facility is the newest radiographic asset. The upgrade to two axes with the capability to perform more than one "exposure" per shot will be completed in FY 03. The DOE stockpile stewardship criteria, however, identified the need for capability beyond DARHT. The proposed future facility is referred to as the Advanced Hydrotest Facility (AHF). A decision is pending concerning the selection of technology for AHF. As of this writing, funds for AHF studies are available and a decision to proceed with an AHF is expected in FY01.

DOE is continuing to assess the information AHF could provide on the performance and predictability of weapon primary functions up to the point of nuclear detonation. According to DOE's criteria and plans, the advanced radiographic capabilities such as AHF would provide essential information for assessment of newly produced weapon primaries, and are directly relevant to assessing both scientific and engineering issues concerning the weapons in the stockpile. The unresolved issues regarding the future of AHF underscore the Panel's recommendation earlier in this section that stockpile information needs and technical criteria are evolving and must be reviewed on an ongoing basis.

Accelerated Strategic Computing Initiative (ASCI): DOE has set its requirements high on enhanced computing hardware, and seems to be meeting those requirements. Since its beginning, the nuclear weapons program has been a prime driver in the advancement of supercomputer technology. However, with all the increases in computing power, the resulting computations are only as valid as the input data and precision of the modeling techniques.

DOE therefore has allocated roughly 35 percent of ASCI funding to the development of advanced weapons performance codes, including efforts intended to ensure that the physics and materials models contained in the codes are based on proven theory and that the codes yield accurate, reproducible results. Other validation activities not funded by ASCI include hundreds of experiments. Thus, the ASCI program is not only developing computers and software, it also is contributing to increased confidence in the stockpile stewardship program.

Data Archiving: A fundamental tool for stockpile stewardship is legacy of test, development, and manufacturing data acquired over the weapons program. Legacy data, especially as they relate to the past underground test program, will be used as the ultimate benchmark against which the new computer codes must be calibrated. Archiving of these precious data is not sustaining the pace that is needed if this goal is to be accomplished while the designers and testers are still available. As we recommended in last year's Report, this effort needs to be accelerated. DOE reports that it recently conducted an "Archiving Summit," and is working to establish processes that will ensure that essential data are preserved and used. The Panel will review progress in this area.

***E. ANNUAL CERTIFICATION
PROCESS***

***Strengthen and Broaden the Annual
Certification Process***

Last year's Panel report noted that, as certification challenges grow, the Annual Certification Process will convey confidence only if national leaders are convinced that it aggressively seeks to identify and report problems in the stockpile. An "all's clear" report after a

thorough scrubbing of the processes, data, and assumptions used in weapon surveillance, assessment, and other relevant activities is the best that national leaders can hope for in ascertaining the safety and reliability of the stockpile.

We are encouraged that the STRATCOM Stockpile Assessment Team has taken up this challenge, engaging more directly in the assessment of stewardship goals, accomplishments, and shortcomings. We urge the team to continue, and also to continue to renew itself by bringing in additional members. As noted earlier, we are also encouraged by the efforts of the laboratories and DOE to strengthen the surveillance, assessment, and annual certification processes. We believe there has been perceptible progress across the board.

The process by which certification takes place is central to confidence in the findings. In describing the roles of the laboratories in the section on NNSA management, we emphasize NNSA's responsibility to ensure that each weapon system in the nation's stockpile is treated as the national responsibility of all three national laboratories, no matter where it was originally designed. Each nuclear laboratory should be responsible to lead or review surveillance strategies, weapons assessments, and the technical reports developed in the Annual Certification Process. The products of such reviews should be documented and reports transmitted to the NWC.

We reemphasize last year's comment that "it is also necessary to attend to unintentional aspects of the [certification] process that may create disincentives for reporting problems." Any such disincentives need to be recognized at all levels in the chain of command, all the way to the President. Congress has taken a needed action by directing that the certification memorandum from the Secretaries of Energy and Defense to the President be classified. This will help ensure that accurate technical assessments can always be included in the formal flow of information to national leaders under all circumstances. Moreover, the issuance of a classified memorandum as a matter of routine removes the possibility that inferences about the state of the deterrent might be made, based on the absence of an unclassified memorandum.

Last year we recommended that the technical certification process performed by the laboratories each year be complemented by a parallel examination of three additional dimensions of stewardship that are essential for sustaining confidence. These include: the adequacy of the people, tools and methods for addressing future problems; the capability of the weapons production infrastructure to find and fix potential problems; and nuclear test readiness, with attention to what might be tested and the added value of such tests.

It is the Panel's intention that these elements of confidence must be reported to the national leadership in the memorandum from the Secretaries of Energy and Defense. Only in this way will national leaders obtain a balanced perspective in judging the state of confidence

they can expect to have in nuclear deterrence capabilities. It is not the Panel’s intention to dilute the technical certification process in place today. A possible approach is for the DOE to assess these three additional dimensions of confidence in preparing the annual Stockpile Stewardship Program Plan, i.e., “Green Book.” This could build on such existing assessment mechanisms as the test readiness report, and the newly created production readiness assessment. Problems in any of these three areas that are expected to undermine the nation’s ability to sustain confidence in the stockpile would be reported in the annual ACP memorandum sent to the President by the Secretaries of Defense and Energy.

Several of the documents prepared for the 1999 Annual Certification Process did, in fact, comment on these areas, and the STRATCOM Stockpile Assessment Team undertook, for the first time, an assessment of the Stockpile Stewardship Program. We are encouraged by this. We remain concerned, however, with the need for formally defined processes to assure that these assessments continue and their results are conveyed to the President.

F. NNSA MANAGEMENT

- *Respond to critical morale issues at the labs and redefine their missions;*
- *Address long-standing management concerns within DOE*

The National Nuclear Security Administration inherits significant organizational and management challenges that are critical to the success of stockpile stewardship.

In 1998, the Chiles Commission concluded that “...the disorderly organization within DOE has a pervasive and negative impact on the working environment...”¹⁵ It is imperative that DOE establish structures and processes that improve morale, define productive relationships among the laboratories, and clarify lines of authority and accountability for nuclear programs and for functional areas such as safety and security. Congress created the National Nuclear Security Administration in large part to establish an Administrator with a sufficiently broad span of control to establish needed management structures and processes.

1. Morale

The review of Los Alamos National Laboratory (LANL) completed this year by Senator Howard Baker and Representative Lee Hamilton found that the recent fire and security incidents have devastated morale and productivity at LANL, that the current demoralization at LANL is dangerous, and that the ability of LANL and the other national laboratories to attract and retain top talent has already been eroded and now stands at serious risk.¹⁶

¹⁵ Commission on Maintaining United States Nuclear Weapons Expertise, *Report to Congress and Secretary of Energy*, March 1, 1999.

¹⁶ Science and Security in the Service of the Nation: A review of the security incident involving classified hard drives at Los Alamos National Laboratory. A report to the President of the United States and the Secretary of Energy by the Honorable Howard H. Baker, Jr. and the Honorable Lee H. Hamilton, September 25, 2000.

With Baker and Hamilton, we believe that it is both imperative and feasible to promote good science and good security by embedding the security mission within scientific programs. Crucial to security is the constant fostering of awareness. Many factors contributed to a decay in awareness of security requirements over the last decade. The situation must be rectified, but in a sensible way. Imposing cumbersome new administrative procedures is no substitute for improving security awareness and practices. The Panel endorses an NNSA effort to actively engage the laboratory directors and the people within the laboratories to restore awareness and establish effective security strategies.

Security issues, this summer's fire, combined with adverse demographic trends, and an eroding workplace environment, have created an impending personnel crisis at the national labs. A large fraction of the current weapon program staff is close to (or past) normal retirement age. There have been insufficient new hires for a number of years. For the first time in the history of the program, laboratory managers are concerned that mid-career employees are resigning. At one of the nuclear laboratories, the percentage of potential hires who reject offers and opt to work somewhere else has gone from 10 percent in the mid-1990s to 40 percent in the first half of 2000.

One encouraging response has been the increase in Laboratory Directed Research and Development funding. Congress has provided the national laboratory directors with added flexibility for initiatives needed to sustain world-class programs.¹⁷ It is important that these funds be used to further advance stockpile stewardship.

The most important needed action, already discussed, is to have a clear national commitment to the stockpile stewardship mission. Stewardship is inherently different from past nuclear weapons missions. It requires more than simply the continuation of past technical activities. It is not possible to attract or retain a world-class staff absent clear articulation of this new stewardship mission and its national importance, and without a credible multi-year program. NNSA, working with DOE leadership, DoD, the President, and Congress must restore the sense of mission, rationalize the work program, and demonstrate commitment to stockpile stewardship.

2. Laboratory roles and responsibilities

The NNSA should define the roles and responsibilities of the three weapons laboratories. This is a critical challenge that is central to the success of stockpile stewardship. In the absence of testing, more uncertainty in weapon performance necessarily results unless action is taken to enhance understanding. One response, as noted earlier, is to create the best possible tools and processes for surveillance, assessments, and annual certification. The Panel believes, however, that the fundamental basis for sustaining confidence is the continued maintenance of independent centers of excellence in nuclear design and engineering at Los Alamos and Lawrence Livermore, with both responsible for the national stockpile and both proactively looking for problems in the stockpile. To implement this philosophy, the NNSA must define effective roles for each

¹⁷ U.S. House of Representatives *Conference Report to Accompany HR 4635*, House Report 106-988, October 2000, p. 264

laboratory in the day-to-day responsibilities for stewardship, and must enforce their implementation.

The Panel believes that each of the weapons within the stockpile should be viewed as a national responsibility of all of the nuclear weapons laboratories. It is necessary to put a stop to the obsolescent belief that each laboratory “owns” the weapons it designed and the information it developed. In fact, this was never the case: Each of the laboratories brings a history of involvement in the development of the current designs for nuclear primaries and secondaries, and each possesses unique knowledge and perspectives that need to be passed along to future generations of stockpile stewards. Laboratory directors therefore should be responsible to ensure that each laboratory has provided a comprehensive review and assessment of each type of weapon, regardless of the laboratory origin of the particular design. These efforts must be coordinated and focused on building the knowledge base for future stewards.

The NNSA must define processes that effectively engage the laboratories in such areas as:

Dual Revalidation: The W76 Dual Revalidation effectively engaged experts from each of the laboratories in updating and documenting the design, test, and manufacturing data. The findings have been incorporated in modern computer codes, and have provided a basis for the planned W76 Life Extension Program. DOE has argued that this Dual Revalidation exercise was excessively time-consuming and expensive. It is argued that Baselining activities (which entail a single lab’s review of data and codes as proposed in the current SSP), combined with the Annual Certification Process and other activities, is the practical equivalent of Dual Revalidation. The Panel disagrees. An inter-laboratory review process engages competing centers of excellence, and therefore is likely to be more effective. We do not support weapon Baselining as an alternative to Dual Revalidation.

The problems encountered in the initial attempt at Dual Revalidation are real. Inter-laboratory review is, and should be, inherently adversarial; but this competition can be managed through NNSA leadership and the recognition of a sense of common purpose. The Panel agrees that a four-year process for each weapon type in the stockpile clearly is too long, and should be shortened. We urge NNSA to examine the lessons from the previous Dual Revalidation and implement a disciplined process for inter-laboratory review.

Earlier in this report, the Panel noted that Sandia is reforming its internal review processes, and has created an independent review organization. It will be useful, to assess the effects of Sandia’s initiatives and determine what lessons may be learned that can improve development and qualification activities in the other laboratories.

Weapon Surveillance, Assessments, and Annual Certification: As noted in our previous recommendations, each laboratory should be responsible to lead or review surveillance strategies, weapons assessments, and the technical reports developed in the Annual Certification Process. The products of such reviews should be documented and reports transmitted to the NWC.

Certification of Warheads with New Components: W88 pit qualification and weapon certification provide critical tests of the capability to certify weapons with replacement nuclear components using the tools that will be provided by stockpile stewardship. Inter-laboratory review is essential at every step in the certification process.

Campaigns: NNSA must effectively engage the nuclear laboratories in establishing realistic plans, milestones, and financial profiles for executing the Campaigns so that their products are available when needed.

Stewardship of Key Experimental Facilities and Capabilities: An integrated strategy should eliminate inappropriate duplication of effort among the national laboratories, while at the same time ensuring the facilities are managed and used as national assets available to all weapons personnel.

Workload Balancing: All of the preceding functions must be accomplished in ways that ensure that all of the laboratories sustain the technical competencies needed to support their participation in inter-laboratory review processes.

3. NNSA organization and management

Congress is requiring NNSA to develop a plan for assigning roles and responsibilities among its headquarters and field organization units, to include the downsizing, consolidation, or elimination of Defense Programs units that may be necessary to enhance efficiency.¹⁸ In accomplishing the needed realignments and reductions, the Panel encourages NNSA to implement the recommendations of the Chiles Commission review and the 1997 “120-Day Study.”¹⁹ Both recommended a thorough revamping to institute streamlined, efficient management.

Three main themes need to be addressed in shaping the new NNSA organization.

First, DOE needs to focus responsibility and authority in its line managers. This requires the integration of programmatic needs with functional requirements. To an increasing extent, DOE functional communities detail how things are to be done within the laboratories and plants. Examples include environmental, health, and safety programs, specific security practices, restrictions on travel, and detailed oversight of compensation programs.²⁰ In effect, a functional chain of command has been established, operating in parallel to programmatic line management. These parallel chains of command cause inefficiency due to diffusion of authority and conflicting objectives. Unfunded mandates to meet functional requirements

¹⁸ Section 3153, *Organization Plan for Field Offices of the National Nuclear Security Administration, Conference Report to Accompany H.R. 5408, The Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001*, p. 484.

¹⁹ Paul H. Richanbach, David R. Graham, James P. Bell, and James D. Silk, *The Organization and Management of the Nuclear Weapons Program*, IDA Paper P-3306, March 1997. Full implementation of the DOE Defense Programs realignment recommendations provided in this 1997 appraisal was recommended by the Senate Armed Services Committee in the report that accompanied its National Defense Authorization Bill, Report 106-292, p. 435.

²⁰ For some of these matters, DOE is required by Congress to exercise special controls, e.g., the Congressionally directed ceiling on Defense Program contractor travel (*Ibid.*, HR Report 106-988, p. 264).

undermine program budget, plans, and milestones. All DOE functional interactions with the weapons complex should flow through NNSA.

Second, roles, responsibilities, and line management structures within NNSA should be aligned with the structure of the NNSA program. NNSA headquarters should provide leadership and perform top management tasks, including: setting objectives; developing strategies, programs, priorities and budgets; providing guidance concerning milestones and objectives; setting measurable goals and appraising performance against these goals; and adjudicating differences among operating entities. Except for selected programs managed from headquarters, NNSA should not focus on the details of task execution. Achieving this goal will require simplifying, clarifying, and disciplining lines of command, communication, and authority with NNSA. Duplication of responsibilities should be eliminated and layers of headquarters and field management or oversight should be consolidated.

This NNSA organization should, to the extent possible, be organized so that roles and responsibilities are aligned with the deliverables of the Stockpile Stewardship Program, rather than by function or facility. Each program should have a headquarters focal point with responsibility and authority for overseeing planning, programming, and execution. Program execution should be the responsibility of a program manager outside of the headquarters. Program management teams can be formed to engage the needed functional expertise from across NNSA to support program managers.

Third, after establishing a basic framework, the line managers of NNSA, the laboratories, and the plants should work together to shed administrative burdens. The Panel heard estimates that some technical staff within the laboratory weapons program spend 30 percent of their time working on administrative actions responding to DOE tasking. In the past, perhaps 10 percent of these staff members' time was spent on such tasks. Eliminating two-thirds of these burdens should be an immediate priority. Based on these management improvements, NNSA can then reduce its staff commensurate with the roles and responsibilities assigned in this new management structure.

G. PLANS, PROGRAMS, AND BUDGETS

Implement an NNSA plan, schedule, and realistic multi-year budget for the Stockpile Stewardship Program, agreed to by the Nuclear Weapons Council (NWC)

It has been six years since the last Nuclear Posture Review (NPR) defined the role of nuclear weapons in support of national security strategy, and identified the required force posture and infrastructure.

Congress has directed that a new NPR be accomplished at the outset of the incoming Presidential Administration.²¹ Congress has also

required a plan for the long-term sustainment and modernization of U.S. strategic forces.²² These activities provide an opportunity to revalidate the roles that nuclear weapons play in support of national strategy, and to define new roles that are emerging.

²¹ Section 1041 in the *Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001*.

²² *Ibid.*, Section 1042.

A *national* review is needed that addresses the roles for nuclear forces; the size and composition of the forces, including the nuclear warheads and delivery vehicles; and the infrastructure necessary to support the forces. Partnership between DoD and DOE is essential to establish a clear understanding of national requirements. Congress therefore has required that both these activities be conducted by the Secretary of Defense in consultation with the Secretary of Energy. The Panel strongly supports this proposal, and believes that this consultation must be defined and approached in the broadest possible terms.

Concurrent with its participation in these national-level reviews, NNSA must respond to Congressional direction to prepare a Future Years Plan (FYP) that presents program goals, tasks, milestones, and funding, looking out at least five years into the future.²³ Only through such programming and planning, done in conjunction with DoD, will it be possible for NNSA to provide a clear and defensible multi-year program, with funding profile, for accomplishing the NNSA mission.

In the absence of such an FYP, the program has operated on a year-to-year basis with the resources available. The weapons enterprise has struggled to meet the growing requirements for safety, security, and the environment, while accomplishing a workload that is modest by historical standards. This has been done by postponing essential maintenance and foregoing needed investments in replacement or improved capabilities. The DOE's 30 Day Review expressed the general consensus of a program that is "wound too tight."

In preparing its FY02 budget submission to be presented to Congress this winter, NNSA must describe a strategy and program that reverses the adverse trends in the weapons complex. The Panel has identified many programs necessary to sustain confidence that are being delayed or under-emphasized. Thus far, these include the following:

- W88 pit production, qualification and weapon certification
- Conceptual design of full-scale pit production facilities
- Restoration of secondary production capabilities
- Surveillance, and Enhanced Surveillance strategies and tools
- Dual Revalidation of weapon designs, and data archiving
- Weapon life extension programs and end-to-end design, fabrication, and certification work
- Production facility critical maintenance backlogs.

The Panel believes the NNSA's FY 02 program and budget must adequately fund these areas. While NNSA has not briefed the Panel on overall needs, the NNSA briefings on the individual elements listed above suggest that addressing these needs will require several \$100s of millions per year, over and above the \$300 to \$500 million for critical maintenance requirements discussed earlier in this report. It may be possible to find efficiencies in other areas of the DOE program to free up some of the needed funds.

²³ Ibid., Sections 3154 and 3155

We urge the NNSA and DoD to work together to define the priorities within the Stockpile Stewardship Program. In developing its program, NNSA needs to engage the nuclear laboratories and plants to collaborate in specifying infrastructure requirements, programmatic goals, milestones, and resource estimates. NNSA also must work through the Nuclear Weapons Council, and its related requirements mechanisms, to ensure that the program responds to the priority requirements of DoD.

In the FY 02 budget cycle, the Panel urges Congress to work closely with the NNSA to review the NNSA strategy, program, and budget in order to ensure that the essential programs for sustaining confidence are adequately directed and supported. Following this, Congress should provide the Administrator the flexibility needed to manage effectively.

H. DoD'S ROLES

The Department of Defense needs to become a more informed customer of the National Nuclear Security Administration

While most of the Panel's reviews involved DOE plans and activities, some attention was given to DoD matters impacting the stockpile. In the past, nuclear forces commanded attention at the highest levels within DoD. The stockpile was continuously upgraded with the newest technology, and the

nuclear weapons complex could generally accommodate the needs of DoD. Today the nuclear complex must maintain the existing stockpile, a very different mission, and nuclear matters have less visibility within DoD.

The Panel is encouraged that the Nuclear Weapons Council has resumed monthly meetings. This provides an valuable forum for NNSA and DoD to coordinate programs and policies for nuclear deterrence.

For DoD and NNSA to have the best hope of succeeding in sustaining confidence in deterrence, the Department of Defense needs to become a more informed customer. This involves developing a better understanding of DoD requirements and of the capability of DOE to meet these needs. The DoD Nuclear Mission Management Plan (NMMP), the second edition of which should be published imminently, will be important in this regard. The NMMP must define end-to-end DoD program needs, to include the requirements of deployed forces, follow-on systems, the science and technology base, C4I, logistics, etc. The DOE Stockpile Stewardship Plan (SSP) must be congruent with the NMMP. In the coordination of their programs, DoD and NNSA must give balanced consideration to both technical and operational solutions for any nuclear weapons issues that may arise, including weapons security relating to the changing global political and threat environment. As with the SSP, it is imperative that the NMMP have clearly defined milestones and budgets.

A senior DoD leadership position for nuclear matters is the Assistant to the Secretary of Defense (Nuclear and Chemical and Biological Defense Programs). The Defense Reform Initiative proposed elimination of this position; Congress did not concur. Recently, this position has been concurrently held by the Director, Defense Research and Engineering. The Panel believes that leadership for nuclear matters within DoD, collaboration between DoD and DOE,

and Congressional oversight would benefit from a return to past practice in which an official was appointed solely to this position by the President, and confirmed by the Senate.

The Panel briefly reviewed the Defense Threat Reduction Agency's programs. The downward trend in funding for nuclear weapon effects research is of concern. Three specific issues were identified in our review. First, there is not an integrated program for DoD and NNSA nuclear weapon effects modeling, simulation, and simulator technology development. DTRA must sustain these capabilities in the context of a national program encompassing both DTRA's and NNSA's capabilities. Secondly, the DoD nuclear weapons effects phenomenology technical base is fragile and perishable. There are adverse aging trends in the workforce, which resides predominantly in the contractor community. Priorities and programs must be established and adequately resourced to allow technology and the workforce to be replenished. As in DOE, doing real work is the best way to sustain competencies. Finally, DoD test readiness needs to be reevaluated and coordinated with DOE plans. As in DOE, test planning assumes lead times that are excessive.

I. TEST READINESS

NNSA should determine the cost and feasibility of reducing the nuclear test response time to well below the Congressionally mandated one year

United States strategy entails maintaining readiness at the Nevada Test Site at a level that would allow testing to resume within one year, following a national decision to do so.²⁴ Test readiness is not inhibited by the CTBT.²⁵

DOE reports that it is prepared to conduct underground nuclear testing within 24 to 36 months, if so directed by the President. The Nevada Test Site has plans that would allow a simple test to be performed within 12 months of receiving a Presidential directive to conduct a test.²⁶

It is the Panel's view that such lead times are unacceptable. This is not because we believe that the need to test is imminent, but because, as a practical matter, a policy of sustaining low levels of readiness could, in the future, rule out the option to test. If a go-ahead is required a year or more in advance of a test, it would be extremely difficult for any President to foresee the impact of the ensuing test preparations on the political environment and the military situation, much less of the results of the test itself. This uncertainty, in and of itself, would create an enormous hurdle to any President in weighing the option to test. Our sense is that no President would make the decision to resume testing lightly. But each President must have the option to resume testing expeditiously, if necessary.

²⁴ *Resolution of Ratification for the START II Treaty*, January 26, 1996, declarations, item 12(e).

²⁵ "With regard to the obligation "not to carry out" any nuclear explosion, the negotiating record reveals that Article I does not limit in any way a State Party's ability to conduct activities in preparation for a nuclear weapon test explosion or any other nuclear explosion." U.S. Department of State, *Article-by-Article Analysis of the Comprehensive Nuclear Test-Ban Treaty, Article I — Basic Obligations*, pp. 3-4

²⁶ U.S. Department of Energy, *Stockpile Stewardship Program, 30-Day Review*, November 23, 1999, p. 2-8, p. 6-4.

It seems prudent to take cost-effective steps to reduce lead times for testing to give future Presidents a practicable set of options for sustaining confidence in the stockpile. The Panel believes that the NNSA should investigate a range of possible options to reduce lead times to, say, three to four months from the President's making a decision to proceed.²⁷

The Panel will give additional attention to test readiness over the coming year.

²⁷ This posture is consistent with past U.S. capabilities and with a reported foreign test readiness capability. For example, between 1995 and 1998, successive Indian governments maintained the capability to test within 30 days of a decision. Chas. Freeman, Jack Matlock, Dick Nelson, and Ken Weisbrode, *Managing Nuclear Arms Competition in South Asia: Work the Problem, Don't Fight It*. Washington, D.C. The Atlantic Council of the United States. July 31, 1998, p. 2.

NEXT STEPS

Next year is the third and final year of the Panel's work. We plan to:

- Examine the status of plans and programs for DOE and DoD underground test readiness
- Monitor progress in the NNSA and its management mechanisms, including its planning and programming processes
- Continue our engagement with the laboratories and production facilities
- Review DTRA programs and the DoD/DOE requirements processes; the Panel will consider weapons security issues associated with the changing global political and threat environment.
- Continue to observe the Annual Certification Process
- Assess the updated certification criteria
- Monitor progress toward the refurbishment and construction of production facilities
- Track and assess progress on our concerns with stockpile stewardship.

In our final year's report, the Panel will identify for Congress the events and accomplishments it should expect to see that would indicate the Departments are doing their best to maintain confidence in U.S. nuclear deterrence capabilities.

APPENDIX A

Assessment of the DOE's Report to Congress on Stockpile Stewardship Tools Criteria

The Strom Thurmond National Defense Authorization Act for FY 1999, in Section 3158, requires the Department of Energy (DOE) to develop clear and specific criteria for judging whether the Stockpile Stewardship Program's (SSP) science-based tools are performing in a manner that will provide an adequate degree of certainty that the nation's nuclear stockpile is safe and reliable. Congress also requires a report from the Department of Energy that addresses these questions: 1) What information is needed to determine that the nuclear weapon stockpile is safe and reliable? 2) What are the science-based tools that are intended to provide that information? 3) To the extent they are known as of the date of submission of the report, what performance criteria are necessary in order for those tools to accomplish their purpose? This spring, the Department of Energy submitted its report to Congress.¹

Section 3159 of that same legislation requires that this Panel shall review and assess the adequacy of DOE's technical performance criteria for proposed SSP tools. This Appendix reports the results of the Panel's review of the criteria presented in the DOE Report.

Findings

Within the limits of current understanding, the Report does a good job of describing the information needs, the kinds of tools being sought to address these needs, and where feasible the technical criteria for the tools that would be required. It addresses these issues in each of four broad technical areas: weapon primary certification, weapon secondary certification, non-nuclear component certification, and Stockpile Surveillance. The Report provides a coherent rationale for the major science-based tools that are the core of the Stockpile Stewardship Program.

Viewed as a first effort, the DOE Report satisfactorily addresses the questions that Congress has posed. In terms of specifying the technical criteria for the tools, it is broad in scope, and is as complete and quantitatively specific as could reasonably be expected at the time that the Report was completed. Therefore DOE has met the specific reporting requirement that Congress set forth.

It is the Panel's view that work on the criteria must continue. In some areas criteria remain undefined or incomplete, notably for advanced hydrotest capability and internal confinement fusion. These criteria will be necessary to meet the Congressional requirement that NNSA employ them as the basis for developing its future year programs:

¹ DOE, "Report on Criteria for Stewardship Tools," May 14, 2000.

The Administrator shall include in the materials the Administrator submits to Congress in support of the budget for any fiscal year that is submitted by the President pursuant to section 1105 of title 31, United States Code, a description of how the funds identified for each program element in the weapons activities budget of the Administration for such fiscal year will help ensure that the nuclear weapons stockpile is safe and reliable as determined in accordance with the criteria established under 3158 of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999.²

Thus, the criteria will form the requirement basis for the NNSA program and budget.

It is the Panel's view that, independent of Congressional intent, the questions posed by Congress are the right ones on which to base assessment of the requirements for new stockpile tools, as well as the likely success or failure of the Stockpile Stewardship Program. Continued focus on these questions, beyond DOE's initial report to Congress, will significantly improve management of the Program. Further, they suggest a useful framework for organizing, prioritizing, and executing the Program.

The value of DOE's work on criteria can be enhanced if the criteria for the new tools are assessed in the context of the process in which they will be used. It has been argued that the use of the tools will require expert judgement applied under circumstances that are impossible to forecast, and that therefore the definition of process at this point is premature. We reject that view. Expert judgment has always been, and will continue to be, the ultimate basis for assessment. Nevertheless, it is necessary to clarify *in advance* the process by which those judgments are made and ensure adequate rigor in finding flaws and describing risks. Plans can be revised as issues emerge, but an *ad hoc* approach to so important and expensive an undertaking cannot be justified.

A Process for Linking Information Needs, Criteria for Stewardship Tools, and Programmatic Milestones and Budgets

An ongoing assessment of the information needs for stockpile stewardship, and the adequacy of the stewardship tools, as embodied in the Congress' questions, should be an integral part of NNSA's ongoing strategic planning process. The results of these assessments should then form the basis for Stockpile Stewardship Program management. We suggest here a possible process by which the NNSA could link the strategic planning for stewardship tools, programs and milestones for developing the tools, and program execution through an integrated management structure. The elements of this structure are discussed below and summarized in the associated figure:

SSP Strategy

Information needs and stewardship criteria definition. Congress specifically cited the need to complete and refine the answers to its questions. At the strategic level, this activity should have the attention of top leadership at NNSA. The Stockpile Stewardship Plan should be the venue for publication of this periodic assessment. The process for preparing this Plan

² Excerpt from the Fiscal Year 2000 Defense Authorization Bill.

provides the mechanism for completing and updating information needs and criteria for tools as understanding grows. Specifically, the Fiscal Year 2001 Stockpile Stewardship Plan, dated June 12, 2000, made a large step beyond the previously submitted Report in clarifying the needs and criteria. This process needs to be formalized, in part by specifically designating responsible parties.

SSP Planning and Programming

Campaign Program Definition. The eight Certification Campaigns³ are most directly relevant to the issue of confidence in the absence of nuclear testing. Residual uncertainty in information needs and tool criteria should not impede NNSA from implementing necessary programs expeditiously. The needs and criteria are imprecisely known now; ten years from now they will still be imprecisely known. It should nevertheless be possible to construct a minimum set of critical information needs associated with the most pressing problems we face in the absence of testing. This should be coupled with an assessment of what information gaps remain, and with what implications for confidence. In short, DOE should prioritize and add detail where it matters most and use the resulting information needs and criteria as the basis for setting requirements for individual programs. Program objectives and resource allocation can be adjusted based on emerging knowledge subject to annual review.

Campaign Program Integration. This activity should track deliverables among Campaigns as well as to the other elements of the SSP (Directed Stockpile Work, Surveillance, etc.) in order to establish rational priorities and milestones. Resource constraints need to be reconciled in this venue, in a manner that respects critical paths and optimizes outcomes for the program as a whole.

SSP Budget and Execution

Annual Future Years Budget Submissions. In the Defense Authorization Act of 2000, Congress requires NNSA to adopt a future-years budgeting process that bases program milestones, priorities, and funding on the information needs and criteria. The necessary linkage can be accomplished through the strategic planning process described above, and linkage of the future years program with the resulting Stockpile Stewardship Plan.

Campaign Program Execution. By congressional mandate, program requirements are to be based on prioritized information needs and criteria. They therefore form the basis for assessing program progress. A milestone system, such as employed in the DoD acquisition system, should be adopted so that each phase of a major program would have specified milestones. At the end of each phase, an assessment occurs to ensure compliance. Such milestones ensure that defined technical events receive senior-level attention within DOE and are visible to Congress. Delegation of specific responsibility for execution of the individual campaigns is essential for successful outcomes. Each Campaign should have one designated government program manager, and each laboratory should designate an official responsible for execution of the work.

³ DOE, "Stockpile Stewardship 30-Day Review." The eight Campaigns are Primary Certification, Dynamic Materials Properties, Advanced Radiography, Secondary Certification and Nuclear Systems Margins, ICF Ignition and High Yield, Certification in Hostile Environments, Defense Applications and Modeling, and Weapon System Engineering Certification. In addition, it would be appropriate to include the Enhanced Surveillance campaign as being vital to the issue of confidence without nuclear testing.

Stockpile Assessment and Annual Certification. Last year, we recommended broadening the Annual Certification process to assess the adequacy of the Program’s people, tools, and facilities as a means to sustain confidence in the stockpile. We suggest that this mechanism is the appropriate one for applying the criteria for the tools. In the end, the value of the tools is determined by their efficacy in dealing with problems in the stockpile. The assessment and certification activities need to determine whether the tools provided are adequate, and feed back the assessment to the top-level strategic planning activity so that decisions can be made concerning the need for enhanced or additional capability.

Information Needs, Stewardship Tool Criteria, and SSP Management

