DOE/NA-0011

Defense Programs

STRATEGIC VISION FOR 2030

February 2005

National Nuclear Security Administration
Office of the Deputy Administrator for Defense Programs

UNITED STATES NUCLEAR WEAPONS STOCKPILE

Bomb	Description	Carrier	Laboratories	Mission	Military Service
B61-3/4/10	Bomb	F-15 & F-16	Los Alamos/ Sandia	Air to Surface	Air Force
B61-7	Bomb	B-52 & B-2	Los Alamos/ Sandia	Air to Surface	Air Force
B61-11	Bomb	B-2	Los Alamos/ Sandia	Air to Surface	Air Force


B61


W62/W78

Warhead	Description	Carrier	Laboratories	Mission	Military Service
W62	ICBM Warhead	Minuteman III ICBM	Lawrence Livermore/ Sandia	Surface to Surface	Air Force
W78	ICBM Warhead	Minuteman III ICBM	Los Alamos/ Sandia	Surface to Surface	Air Force

Warhead	Description	Carrier	Laboratories	Mission	Military Service
W76	SLBM Warhead	C4 & D5 Missiles, Trident Submarines	Los Alamos/ Sandia	Underwater to Surface	Navy
W88	SLBM Warhead	D5 Missile, Trident Submarines	Los Alamos/ Sandia	Underwater to Surface	Navy


W76/W88


W87

Warhead	Description	Carrier	Laboratories	Mission	Military Service
W87	ICBM Warhead	Peacekeeper ICBM	Lawrence Livermore/ Sandia	Surface to Surface	Air Force

Bomb	Description	Carrier	Laboratories	Mission	Military Service
B83	Bomb	B-52 & B-2	Lawrence Livermore/ Sandia	Air to Surface	Air Force


B83


W80

Warhead	Description	Carrier	Laboratories	Mission	Military Service
W80-0	TLAM-N	Attack Submarine	Los Alamos/ Sandia	Underwater to Surface	Navy
W80-1	ALCM/ACM	B-52	Los Alamos/ Sandia	Air to Surface	Air Force

The Inactive Nuclear Weapons Stockpile also includes the W84, designed by Lawrence Livermore and Sandia National Laboratories.

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INTRODUCTION FROM DR. BECKNER

Dr. Everet H. Beckner
Deputy Administrator for Defense Programs

The U.S. nuclear weapons enterprise must rapidly evolve to a more sustainable path. The National Nuclear Security Administration, in concert with the Department of Defense, must move away from a Cold War deterrence strategy and develop a new way of supporting the national security requirements which require a fully credible nuclear deterrent against all future threats, but within a constrained resource envelope.

The U.S. is undergoing a fundamental shift in national security strategy to address the realities of the 21st century and, in accordance with the Nuclear Posture Review, is placing more reliance on conventional capabilities to assure our allies, dissuade competitors, deter aggressors, and defeat our enemies. Nonetheless, the Nation will continue to rely on nuclear weapons as a critical part of the strategy to achieve that goal and, in an uncertain world, will place an increased reliance on the ability to rapidly develop and field a response to emerging threats rather than relying solely on operationally ready nuclear weapons. The President has directed us to initiate actions toward that goal.

Reexamination of the physical security requirements for nuclear weapon facilities dictates an increase in resources devoted to addressing potential threats. Also, the threat clearly includes malevolent acts using one of our weapons as well as that posed by primitive weapons deployed by rogue nations or sub-national groups. Surety improvements within the weapons can help reduce the threat of malevolent acts, and implementing those changes is an important stockpile transformation parameter.

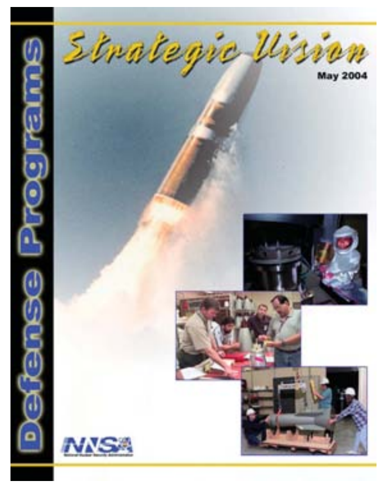
At the same time, in keeping with the reduced role of nuclear weapons in achieving our national security goals, the Nation is expecting a reduction in the cost of the nuclear enterprise and a return on the decade of investments in the Science-Based Stockpile Stewardship Program. Both Congress and the Administration have sent clear messages of this expectation and the nuclear weapons enterprise must respond. At the current budget levels, the enterprise has very little headroom to develop the important, new responsive capabilities.

Defense Programs (DP) must choose a path between two extremes: optimizing a strategy that sustains the existing stockpile and enterprise but does not address potential new threats, or, focusing on preparing for a broad array of potential new threats. Choosing one extreme or the other is clearly unwise, and DP will continue to work with the Department of Defense and Congress to arrive at the proper nuclear weapon capability for the future, both in terms of the stockpile and the capabilities of the nuclear weapons complex. We must identify and execute strategies that optimize cost versus acceptable risk while transforming the stockpile and the supporting enterprise to better address nuclear deterrent requirements within available resources. I am committed to working with the Department of Defense and Congress to pursue these strategies and meet our obligations to the Nation.

Everet H. Beckner
Deputy Administrator for Defense Programs

DEFENSE PROGRAMS STRATEGIC VISION FOR 2030

Over the past two years, the National Nuclear Security Administration's (NNSA) Office of Defense Programs (DP) has been developing a vision for the future nuclear weapons stockpile and its supporting NNSA infrastructure. This vision was derived from a number of sources, including the 2001 Nuclear Posture Review, discussions at the 2003 Stockpile Stewardship Conference held at U.S. STRATCOM, the Strategic Capabilities Assessment (SCA) and Administration guidance on the implementation of the Treaty of Moscow. The result was the issuance of the ***DP Strategic Vision*** in May 2004. That document was a vehicle to engage a wider community of senior managers within the Nuclear Weapons Complex (NWC) to further refine this vision into a tool that can guide decisions on future investments in the NWC. To this end, Strategic Management Retreats were held on September 13-14, 2004, and again on November 9, 2004, and the tasking coming out of those retreats was to take the ideas and discussions raised there and incorporate them into an updated vision, or planning scenario, that can be used to guide future DP plans. This document defines the future state to be used for planning purposes.



The May 2004 DP Strategic Vision.

Test being run with a W80 System Tester that will be used at the Pantex Plant.

DEFENSE PROGRAMS VISION

As stated in the current FY 2006 Defense Programs Planning Guidance, the DP Vision is:

> "Provide the Nation with an integrated nuclear security enterprise, consisting of research, development, engineering, test, transportation, and production facilities that operate a responsive, efficient, secure, and safe NNSA capability and that is recognized as preeminent in personnel, technical leadership, planning, and program management."

To accomplish this vision, the DP Strategic Vision for 2030 is built around a small number of fundamental assumptions that, once validated, logically drive the complex to a particular future state. These assumptions are:

A B61-4 trainer using an aircraft monitor and control package that simulates the electronic control system of several types of military aircraft.

Fundamental Assumptions

1. The U.S. is a nuclear weapons state, second to none.

2. U.S. nuclear weapons capabilities will support the Nation's defense policy goals to assure allies, deter aggressors, dissuade competitors, and defeat enemies.

3. Safety and security of the stockpile is of paramount importance, and is a primary NNSA responsibility.

Ancillary Assumptions

4. Well before 2030, the adequacy and sustainability of Science-Based Stockpile Stewardship will have been accepted by the U.S. government and the science community as a working strategy to provide assurance of the safety and reliability of the weapons in the stockpile.

5. The stockpile will be maintained and transformed consistent with DoD requirements without requiring underground nuclear testing. However, NNSA will maintain a state of readiness in case testing becomes necessary in the future.

6. Based on the DoD Transformation study, the future stockpile will likely contain some replacements for today's weapons and/or the Life Extension Program (LEP) weapons. The future Responsive Infrastructure and the concept of Reliable Replacement Warheads (RRWs) will make available weapons with improved safety, security, reliability and performance margins.

7. The U.S. weapons program will continue to have sufficient quantities of plutonium and highly enriched uranium for its needs. The U.S. will produce and process tritium as required to meet program needs.

8. Consistent with DoD requirements and to offset the risk implicit in reducing the U.S. nuclear stockpile significantly below current levels, a Responsive Infrastructure strategy will be implemented, as noted in Assumption 6 above.

9. NNSA will have responsibility for environmental restoration for those sites where it has continuing operations, as well as responsibility for any newly generated waste. The NNSA Office of Infrastructure and the Environment will be responsible for managing legacy waste and restoration activities at NNSA sites. DP is responsible for management of newly generated waste at its sites.

OVERARCHING CONSTRAINT

The final assumption is also the over-arching constraint on the 2030 vision:

10. For purposes of planning, the budget for weapon activities will be assumed to remain level through completion of LEPs and the re-engineering of the complex. Beyond those events, the budget will likely decline. Should budgets decline sooner, LEPs will be protected at the expense of schedule, scope, or increased risk, if necessary.

These assumptions will be used to define the magnitude and characteristics of the 2030 stockpile and the supporting NWC infrastructure.

These assumptions have a cascading set of implications that are developed below.

FUNDAMENTAL ASSUMPTION:

1. The U.S. is a nuclear weapons state, second to none.

This fundamental assumption underpins all our plans for the future. This assumption states that, in 2030, the U.S. has a nuclear weapons stockpile and Department of Defense (DoD) delivery systems sufficient to support National policies and strategies. The existence of a stockpile implies the U.S. has a Research, Development, and Testing (RD&T) capability to support this stockpile as well as a production, transportation, and maintenance capability. This fundamental assumption, by itself, does not dictate a stockpile of any particular size or composition, nor the size and capabilities of the NWC infrastructure, only that they ***must*** exist.

FUNDAMENTAL ASSUMPTION:

2. U.S. nuclear weapons capabilities will support the Nation's defense policy goals to assure allies, deter aggressors, dissuade competitors, and defeat enemies.

This assumption is codified in the 2001 Nuclear Posture Review as it applies to NNSA and, through additional actions by the President, provides for sizing of the U.S. nuclear weapons stockpile and, ultimately, the DP laboratory and plant infrastructure.

W87 Peacekeeper warheads.

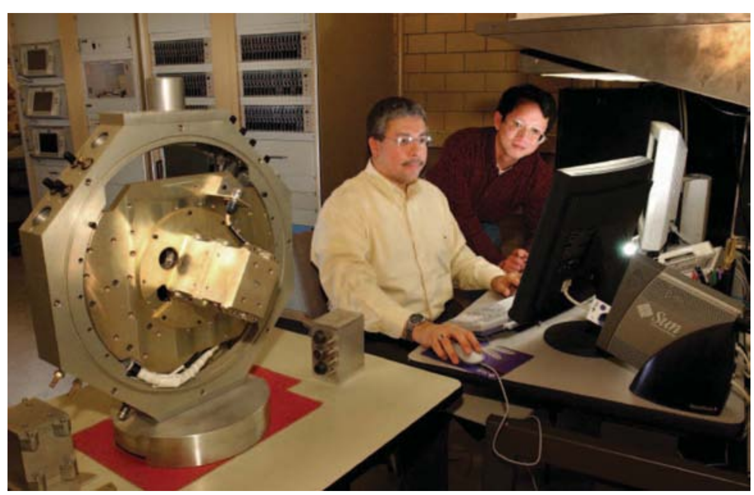
Predicting twenty-five years into the future is filled with uncertainty. It is unlikely that anyone twenty-five years ago would have predicted the current geopolitical environment. It is conceivable in the future that one or more nuclear weapon states will try to challenge U.S. leadership in various arenas. Against this possibility the most conservative approach to sizing the stockpile of 2030 requires that the U.S. be able to rapidly respond to a near-peer adversary, or some combination of adversaries. The magnitude of potential threats and the pace of our production capability largely specify the size of the operationally-ready U.S. stockpile. For the U.S. to deter or dissuade all potential nuclear enemies, the total U.S. stockpile will probably remain in the range of a few thousand (vice significantly less than 1,000 weapons). The NWC (production and R&D) must be sized and maintained to support this stockpile.

FUNDAMENTAL ASSUMPTION:

3. **Safety and security of the stockpile is of paramount importance, and is a primary NNSA responsibility.**

The NNSA must begin an evolutionary transformation of the stockpile to incorporate improved security and safety. Much of the Cold War-optimized stockpile will become increasingly unsuited to meet the safety and security challenges of the coming decades.

The current nuclear weapons stockpile was designed and manufactured primarily in the 1970 –1990 timeframe and optimized to parameters consistent with the Cold War constraints and objectives. While built to the safety and security standards of the era, those standards have, and will continue to evolve in the face of new threats, new capabilities, and the recognition that some of the previous design constraints can be relaxed. For example, the need to maximize the yield to weight ratio on some weapons led to the decision to retain conventional high explosive (CHE) in some designs even though insensitive high explosives (IHE) were coming into general use in other designs. The intrinsic safety improvements that IHE provides argues strongly for upgrading the CHE systems, particularly in light of the fact that the weight and volume constraints that led to selection of CHE in the first place may no longer be as applicable. Fire-resistant pits



Sandia National Laboratories employees involved in designing and building testers that will be used at the new Weapons Evaluation Test Lab at the Pantex Plant.

A Federal Officer training with a firearm.

are another technology that has been only partially deployed into the current stockpile but could offer additional safety margins in some accident scenarios.

U.S. weapons must be secure against a recognized credible threat that has changed radically, particularly since September 11, 2001. Some have postulated that the greatest nuclear threat to the American public may be a malevolent act using stolen weapons. The NNSA has been developing surety technologies for several decades and it may now be possible to field weapons that are intrinsically secure, i.e. weapons designed such that even if we lost physical control of a warhead, a technologically sophisticated adversary could not use it immediately against us. These technologies can be made available and we must press forward with the development efforts needed to deploy them.

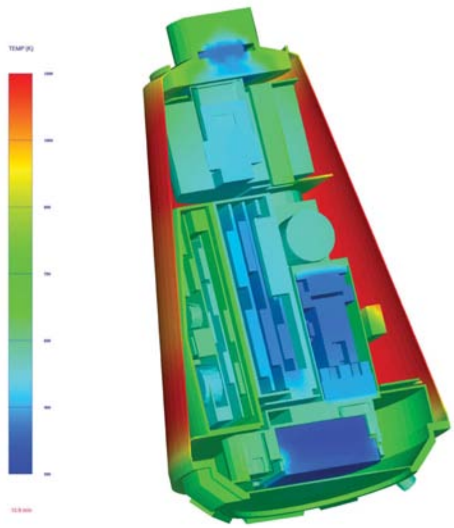
Changing the characteristics of the stockpile will take a long time, and may not be complete by 2030. Nonetheless, the NNSA would be remiss in its responsibilities if it were not implementing a plan to bring the stockpile up to the next level of safety and security standards. In order to do so, the NNSA and DoD may need to reexamine the required military characteristics for the deployed stockpile. Because of the need to support on-going work, including dismantling thousands of Cold War-era weapons, and other constraints delineated below, the NNSA, with DoD, will probably not be able to start significant transformation of the current stockpile until around 2015.

The following assumptions do not help define a specific future state but do help define the environment in which the transformation will occur.

ANCILLARY ASSUMPTION:

4. **Well before 2030, the adequacy and sustainability of Science-Based Stockpile Stewardship will have been accepted by the U.S. government and the science community as a working strategy to provide assurance of the safety and reliability of the weapons in the stockpile.**

Science-Based Stockpile Stewardship has been underway for almost a decade now, and has enjoyed many successes. Many of the tools and capabilities planned for development are either now online or will be within the next decade. Current capabilities include the ability to conduct sub-critical experiments at Nevada Test Site (NTS), a high-performance plutonium gas gun (JASPER), the first arm of the Dual Axis Radiographic Hydrodynamic Test (DARHT) facility, initial experimental capabilities at NIF, and access to 100 TeraOp computing platforms. The plan is



Computer simulations provide vital information about the design of nuclear weapon systems.

underway to develop fusion ignition at NIF to provide nuclear burn for validation of weapons simulations. Within the next decade, the program should be increasingly able to provide definitive answers to current stockpile issues, including the life expectancy of plutonium components and the impact of process changes on dynamic material properties. It will also provide the capability to model the effects of engineering changes in 3-D weapon codes to support certification and assessment. However, success is not assured since it requires fusion ignition and high fidelity computer simulations that have never been achieved.

Quantification of Margins and Uncertainties (QMU) is a science-based methodology that has been developed at the NNSA weapons laboratories as a way to determine the sensitivity of particular designs to various physical parameters, including manufacturing variations and maintenance intervals. The overarching goal is that QMU, together with other Science-Based stockpile stewardship capabilities, will be sufficient to maintain the U.S. nuclear deterrent into the indefinite future. As QMU matures, it enhances the possibility of analytically evaluating design changes and quantifying the impact. QMU, in conjunction with other stockpile stewardship tools, will allow the NNSA weapons laboratories to confidently design and produce new weapons that are intrinsically safer and more secure without the need to return to underground nuclear testing.

As the stockpile stewardship tools are completed and brought into operational use, program investments are expected to shift from RD&T to production and support activities. Maintenance of an RD&T capability will always be required, but the magnitude of the investment as a percentage of the total program should decrease. Another possible implication of the successful implementation of Science-Based stockpile stewardship is that by 2030, the nuclear test readiness posture that needs to be maintained for technical reasons could be relaxed, if political imperatives are also reduced.

The Advanced Simulation and Computing Campaign is developing some of the world's largest high-end computers, needed to satisfy the unique simulation requirements of the Stockpile Stewardship Program.

ANCILLARY ASSUMPTION:

5. **The stockpile will be maintained and transformed consistent with DoD requirements without requiring underground nuclear testing. However, NNSA will maintain a state of readiness in case testing becomes necessary in the future.**

The Test Readiness Program maintains the assets and capabilities needed to conduct an underground nuclear test.

As discussed in the preceding section, successful implementation of QMU may enable the U.S. to maintain and transform the stockpile without resorting to underground nuclear testing. As safety and security improvements are introduced into the stockpile, designs that minimize or avoid the need for underground nuclear testing will be given priority. At the 2003 Stockpile Stewardship Conference, the Risk Panel explored the utility of returning to testing and concluded that testing could be a useful adjunct to the Stockpile Stewardship Program, but there was no compelling reason to return to testing at that time. Further, as QMU and Stockpile Stewardship continue to mature, it will become increasingly less likely that testing will be required for technical reasons. Nevertheless, the Panel could not guarantee that a stockpile issue requiring testing for resolution will not arise, and, hence, maintaining a test readiness posture is a prudent precaution.

ANCILLARY ASSUMPTION:

6. **Based on the DoD Transformation study, the future stockpile will likely contain some replacements for today's weapons and/or the LEP weapons. The future Responsive Infrastructure and the concept of RRWs will make available weapons with improved safety, security, reliability and performance margins.**

The transformation of the nuclear arsenal will occur over an extended period of time, and may not be complete by 2030. Indeed, it may never be complete, as safety and security criteria continue to evolve. There will always be a mix of weapons in the stockpile, and by 2030 we should be in a mode of continuously changing out the very oldest weapons with weapons that have improved safety and security features (Assumption 3) incorporated into them. Maintaining a "warm" production with a relatively low annual throughput, but with the capability to "surge" if necessary, will be a key aspect of the NNSA's Responsive

Infrastructure strategy discussed later. A key driver for the transformation of the stockpile will be to improve safety, security, and reliability. At the same time, if requested by DoD and authorized by Congress, the NWC will be able to design and field weapons with new capabilities. The RRW program is to demonstrate the feasibility of developing reliable replacement components that are producable and certifiable for the existing stockpile. The RRW program will help focus NNSA's transformation to a Responsive Infrastructure.

ANCILLARY ASSUMPTION:

7. **The U.S. weapons program will continue to have sufficient quantities of plutonium and highly enriched uranium (HEU) for its needs. The U.S. will produce and process tritium as required to meet program needs.**

The current U.S. stockpile was designed in an era when plutonium and HEU were in limited supply. These limitations, together with the need to optimize the designs around yield to weight ratio, were major design constraints. Those optimizations, and the extent to which they pervade the full-scale test databases, are now the source of many of the uncertainties and concerns with maintaining the current and future stockpile. A future stockpile significantly smaller than Cold War levels means that for the foreseeable future the U.S. will not need to produce new plutonium or HEU. Our tritium production strategy using Tennessee Valley Authority reactors allows surge production if needed.

ANCILLARY ASSUMPTION:

8. **Consistent with DoD requirements to offset the risk implicit in reducing the U.S. nuclear stockpile significantly below current levels, a Responsive Infrastructure strategy will be implemented, as noted in Assumption 6.**

The 2001 Nuclear Posture Review has articulated goals for a "responsive nuclear weapons complex" that will provide an appropriate balance between research and development (R&D) and production capabilities to be able to meet a range of future eventualities. The weapons complex still needs substantial change in order to fulfill its role in a "Responsive Infrastructure" that can both support an aging and evolving stockpile and also provide an agile response to unforeseen developments and/or potential new requirements for nuclear warheads.

Adjustments being made at a high vacuum neutron tube bake station at the neutron generator facility.

"Responsive" refers to the ability of the nuclear weapons enterprise to anticipate stockpile surprises or innovations by an adversary and to counter them before our deterrent is degraded. These program activities are required while continuing to carry out

Figure 1 - Responsive Infrastructure Goals

CAPABILITY	Response Time * (months)
Augment Stockpile	1
Resolve Stockpile Issues	12
Adapt Existing Weapons	18
Develop New Weapons	36
Perform Safe Underground Test	18

Resolve Any Issue < 3 Yrs

the day-to-day activities in support of the stockpile. Unanticipated events could include catastrophic failure of a deployed warhead type. Emerging threats could call for new warhead development or support to DoD in force augmentation.

A key measure of "responsiveness" is how long it would take to complete certain activities to address stockpile "surprise" or deal with new or emerging threats (see Figure 1). Properly implemented, a Responsive Infrastructure strategy will reduce the overall costs of the nuclear weapons complex. DP will implement a Responsive Infrastructure strategy as a series of projects and initiatives, each with the goal of reducing RD&T and production costs and significantly reducing the timeframe to design and field new capabilities.

ANCILLARY ASSUMPTION:

9. **NNSA will have responsibility for environmental restoration for those sites where it has continuing operations, as well as responsibility for any newly generated waste. The NNSA Office of Infrastructure and the Environment will be responsible for managing the legacy waste and restoration activities at NNSA sites. DP is responsible for management of newly generated waste at its sites.**

NNSA will assume responsibility for environmental restoration of its sites beginning in FY 2006. The environmental restoration activities include legacy waste treatment, storage, and disposal and environmental remediation for sites where NNSA will have continuing operations, as well as newly generated waste at the Lawrence Livermore National Laboratory and the Y-12 National Security Complex. Responsibility for newly generated waste at other NNSA sites was transferred by prior agreements. Additionally, the realignment includes the waste disposal facilities at the Nevada Test Site. Excess contaminated facilities will be scheduled for demolition, and will be subject to continued surveillance and maintenance to minimize environmental risk. As environmental restoration completes, long-term stewardship will be managed by NNSA. Within the NNSA, responsibility for environmental restoration and newly generated waste resides with the Associate Administrator for Infrastructure and the Environment.

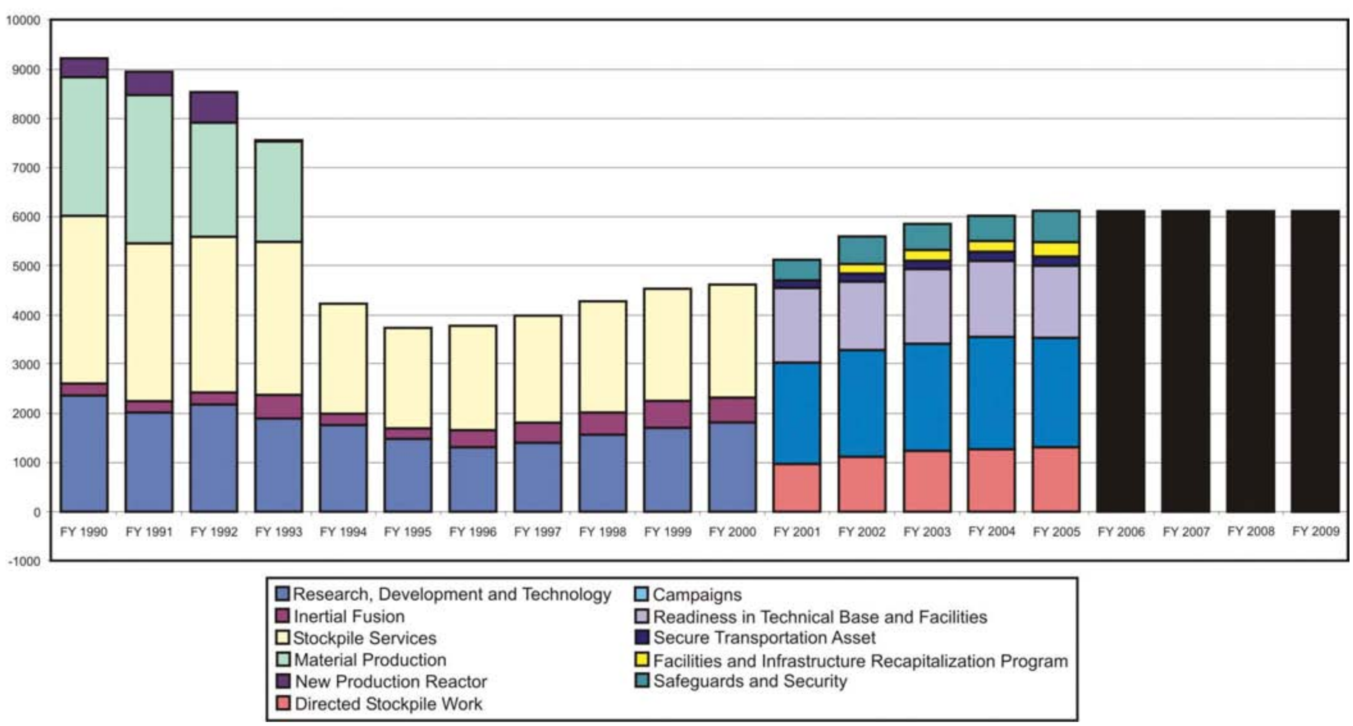
BUDGET PROJECTIONS ESTABLISHES BOUNDARIES ON THE 2030 VISION:

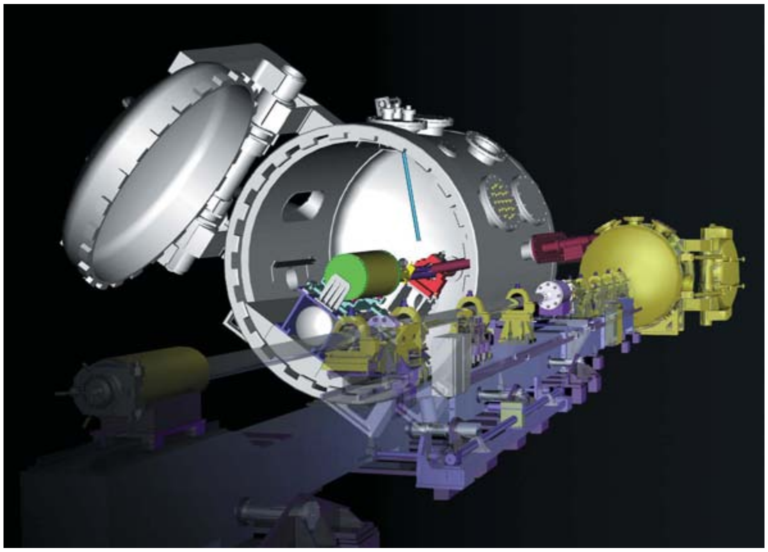
10. For planning purposes, we assume the budget for nuclear weapon activities will remain level through completion of LEPs and re-engineering of the complex. Beyond those events the budget should decline.

For the past several years, the nuclear weapons budget has grown, but in the future is expected to at best remain relatively constant when adjusted for inflation (Figure 2). In defining a vision for 2030, the assumption that the budget will remain relatively flat will be the key constraint. Building on the first three fundamental assumptions, this assumption will drive the pace at which we can transform both the complex and the 2030 stockpile.

Under the assumption of a constant budget, a number of implications arise. First and foremost, pressure to improve security at nuclear weapon complex sites will increase the need for the NWC to become smaller, more productive, and efficient. If we are to identify funds for transformation of the NWC as well as to fully support the stockpile, DP must begin to develop strategies for productivity gains now.

Figure 2 - Nuclear Weapons Complex Funding
(Constant FY 2002 dollars)





The Joint Actinide Shock Physics Experimental Research facility at the Nevada Test Site is home to the two-stage gas gun, a 30-meter-long, two-stage device to strengthen scientists' ability to ensure that the Nation's nuclear stockpile is safe and reliable.

TRANSFORMING THE NUCLEAR WEAPONS COMPLEX

The NWC must evolve into a more sustainable complex. Several factors will drive the complex in this direction, with security costs likely to be the most significant. Currently, the NWC consists of three national laboratories (two with production missions), four production facilities, and the Nevada Test Site (NTS). The philosophy to date has been to downsize in place. This philosophy requires maintaining eight guard forces, multiple security areas, and significant level of secure transportation to move parts, material, and weapon components between sites. Without significant budget increases, this approach is probably not sustainable in the long term.

In the near-term, consolidating Manufacturing and Operating (M&O) contracts may provide improved efficiencies and, hence, savings by implementation of standardized accounting, human resources, information technology, and procurement activities, as well as allowing increased flexibility to shift personnel between sites, to address short-term issues.

Another area with the potential of near-term savings within the NWC is the elimination of duplicate capabilities. For example, high explosives research is conducted at the Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and NTS. Similarly, hydrotesting is performed at multiple locations. All three weapon laboratories have significant computing capabilities, even though secure computing at remote locations has been demonstrated and is in use. An alternative near-term strategy may be to designate centers of excellence. For instance, centers of excellence could be designated for: hydrotesting, computing, high-energy density physics, high-explosive manufacturing, plutonium R&D, and non-nuclear design and manufacturing, among others.

Reducing the number of sites that DP operates would obviously reduce security costs. In the long-term, the ability of the NNSA to accomplish its mission within a fixed budget may require closing sites and/or consolidating activities. Where possible, non-nuclear manufacturing or material supply chains will be outsourced. Consolidation of the NWC will have to be managed very carefully, because the Complex will have to continue to operate throughout this consolidation in order to meet the immediate needs of the stockpile. The nature and recommendations for the consolidation of the NWC will be developed in a study that the Secretary of Energy has directed for completion in FY 2005.

If we can consolidate activities into fewer sites and smaller footprints, security risks, as an example, can be reduced leading to lower costs and improved security. Carefully choosing a consolidation path that leads to reduced risks and costs can substantially add efficiencies. Each site will likely be affected and an integrated, enterprise approach must be pursued to achieve maximum cost savings.

Transforming the Stockpile

The other way that the NNSA can free up the funds needed to transform to a safer, more secure stockpile is by ensuring that future nuclear weapons will be designed with life-cycle cost as a major design criterion, after safety and security. The design will enable reduced total life-cycle costs, including the cost to manufacture the weapon, the cost to maintain the weapon by both DoD and NNSA, and, the cost to dismantle the weapon. Assuming a total U.S. stockpile of thousands of weapons (Assumption 2), the 2030 NWC should have the capability to produce on the order of 100 weapons per year. This is in addition to refurbishment, dismantlements, and surveillance.

The ability of the weapons design community to assess and implement design enabling changes such as IHE and the elimination of hazardous, difficult to process materials now designed into weapons will be an important aspect of improving safety, security, and cost effectiveness. The security aspects alone warrant these changes.

By 2030, there may be fewer warhead types than are currently present in the stockpile. Any required future weapons will, to the extent practical, be built around a limited number of modular components including standardized new pit and secondary designs. The concept is to have a few pre-qualified designs of each functional subsystem to be used in future warheads designs, i.e., a couple of pit designs, secondary designs, gas transfer systems, and firesets incorporating advanced use-control and safety features. Robust manufacturing and performance margins can be incorporated into these subsystems. Ease of manufacturing, inherent safety and use control, designed-in longevity, and certification without underground nuclear testing will be major design goals for these future systems. Development of the RRW in concert with implementation of Responsive Infrastructure will start the NWC moving in this direction.

Risks

Funding: The transformation of the Complex to a smaller, more cost-effective size will require redirection of fiscal resources. Budget cuts may result in insufficient funds to accomplish the end goal.

Deterrent Requirements: The approach envisioned by this document may not meet DoD deterrence needs. As the Complex is in the midst of its transformation, the international environment could rapidly turn for the worse which would dictate the reestablishment of a larger nuclear deterrent than would be possible to achieve.

The National Ignition Facility, with its laser beamlines focused on a tiny target, is the world's largest laser project. Scientific experiments are underway.

Leadership: Several decisions must be made almost immediately to realize substantial cost savings. Failure to make these decisions or delaying these decisions will be, in effect, decisions to continue the status quo and the opportunities for the savings will be lost.

Skills: The creation of "gaps" in design and production timing, while enabling a transformation of the Complex infrastructure might not provide sufficient work to maintain the skill sets of nuclear weapons designers and manufacturers. This would cause morale to decline and a possible loss of critical expertise.

Capabilities: Unless carefully planned and executed, Complex capabilities could be eliminated before sufficient assets (e.g., piece parts) are in place to "carry the weapons program" through to the time new capabilities are on line (such as the situation that occurred when Mound, Pinellas, and Rocky Flats were closed).

PLANNING PRINCIPLES FOR THE 2030 STOCKPILE AND ASSOCIATED INFRASTRUCTURE:

The following summarize the implications developed above:

- The U.S. will maintain an RD&T and production infrastructure in support of a nuclear stockpile that totals a few thousand weapons of various types.
- If required by the DoD and authorized by Congress, the capability to incorporate special features for special targets will be included in specific warheads to address emerging threats.
- The NWC will have the capability to produce all nuclear components.
- To hold down costs while significantly improving safety and security of the stockpile, beginning around the 2015 timeframe, some characteristics of the weapons in the stockpile will begin to be transformed in comparison to the current stockpile (improved manufacturability).
- Modified warheads will include new technologies designed for security, manufacturability, ease of maintenance, increased performance margins, increased safety and use-control, improved longevity, and will minimize the use of difficult to handle materials and processes that threaten the environment.

- Environmental, safety, and health regulations will continue to be stringent, but manageable.

- The workforce will be highly trained, flexible, mobile, and smaller, consisting of federal and contractor employees whose mix may change rapidly.

To achieve these characteristics of the long-term stockpile, the following will be a necessary but, perhaps, not sufficient set of achievements:

- The planned Life Extension Programs for the W76, W80, and B61 will be completed, though probably at lower numbers of refurbished weapons than originally envisioned.

- The Inertial Confinement Fusion and High Yield Campaign and the Science Campaign will obtain the data and understanding needed to certify modified and new warheads.

- The NNSA will develop and institute a Responsive Infrastructure strategy to provide rapid deployment of modified or new warheads to meet emerging threats.

- The backlog of weapons to be dismantled and disposed will be worked off, and excess and enduring nuclear materials will be stored safely.

A Sandia National Laboratories researcher demonstrates the setup he and his team created to peer into the center of Sandia's Z machine at the moment of firing. The crystal under his finger is attached to portions of a Z target configuration.

- Surveillance of the stockpile will be thoroughly planned and executed, with the results analyzed to ensure safety, security, and reliability.

- If required by DoD and authorized by Congress, advanced concepts will be developed and fielded for future application.

- Development, certification, and production tools will be established to realize desired stockpile attributes.

- Certification capabilities, without using nuclear testing, will be established for existing or modified warheads. Large, high-performance computing capabilities will be a critical element of this strategy.

- The Secure Transportation Asset fleet and agent force will be properly sized to meet mission requirements and will be responsive to the dynamic requirements of the NWC.

- The NWC will seek to measurably improve efficiency by installing modern business practices and designing easy-to-manufacture weapon components.

- In time, on a complex-wide basis, activities will be downsized and existing facilities modernized or replaced. Inter- or intra-site consolidation of missions and functions may occur.

ACRONYMS

CHE	Conventional High Explosive
DARHT	Dual Axis Radiographic Hydrodynamic Test
DoD	Department of Defense
DP	Defense Programs
HEU	Highly Enriched Uranium
IHE	Insensitive High Explosive
JASPER	Joint Actinide Shock Physics Experimental Research
LEP	Life Extension Program
M&O	Manufacturing and Operating
NIF	National Ignition Facility
NNSA	National Nuclear Security Administration
NTS	Nevada Test Site
NWC	Nuclear Weapons Complex
QMU	Quantification of Margins and Uncertainties
R&D	Research and Development
RD&T	Research, Development, and Testing
RRW	Reliable Replacement Warhead
SCA	Strategic Capabilities Assessment
STRATCOM	United States Strategic Command
U.S.	United States

National Nuclear Security Administration

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1000 Independence Avenue, SW
Washington, D.C. 20585

Printed with soy ink on recycled paper