Chapter 2
Stockpile Management, Processes, and Organizations

2.1 Overview

Stockpile management is the sum of the activities, processes, and procedures for the design, development, production, fielding, maintenance, repair, storage, transportation, physical security, employment (if directed by the president), dismantlement, and disposal of U.S. nuclear weapons and their associated components and materials. It ensures that the stockpile is safe, secure, and reliable to perform as the nation's nuclear deterrent. Stockpile management involves the care of the weapons from cradle to grave, including concept development, design engineering, manufacturing, quality assurance, maintenance, and repair. Because of the sophistication and intricacy of U.S. nuclear weapons and the numbers of weapons and components involved, stockpile management is a complex undertaking, and the consequences of error in its execution could be very significant.

The stockpile management process is dynamic. Programs and activities must be properly coordinated to ensure that all U.S. nuclear weapons will work how and when they are supposed to and that they remain safe and secure at all times. For example, weapon surveillance,[1] scheduled maintenance, refurbishment programs, and assembly/disassembly activities must all be coordinated against significant funding constraints and within the bounds of the physical infrastructure and human capital available to the mission. Ensuring that each process is completed on time, in sequence, and within budget is a monumental undertaking that is further complicated by the need to coordinate all stockpile management activities between two federal departments, the Department of Defense (DoD) and the Department of Energy (DOE) through the National Nuclear Security Administration (NNSA).

2.2 Stockpile Management Evolution

The U.S. approach to stockpile management has evolved over time to reflect the military and political realities of the national and international security environment, as well as U.S. national security priorities and objectives. From 1945-1991, the United States utilized a design-produce-retire-replace sequence for nuclear warheads; warheads were designed, developed and produced, deployed in the stockpile—usually for a period of 15 to 20 years—and retired and dismantled to be replaced by new, more modern weapons that generally offered enhanced military capabilities and better safety and security features. Figure 2.1 illustrates U.S. stockpile management during the Cold War. This continuous replacement cycle was used throughout the Cold War to ensure U.S. stockpile weapons exploited technological advances and achieved the greatest military performance possible.

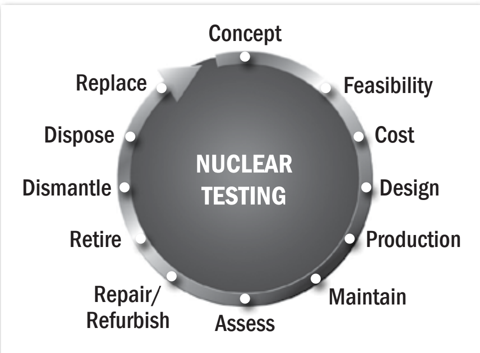

Figure 2.1 U.S. Stockpile Management during the Cold War

During the Cold War, a primary goal of U.S. nuclear weapons was to get the most yield into the smallest possible package (meaning maximum yield-to-weight ratio) as warheads were designed to be carried by increasingly more sophisticated and more capable delivery

[1] *Surveillance* is the term used to describe the activities involved in making sure the weapons continue to meet established safety, security, and reliability standards. Surveillance involves system and component testing and is conducted with the goal of validating safety, estimating reliability, and identifying and correcting existing or potential problems with the weapons. As the stockpile continues to age well beyond its original planned life, the quality assurance approach has been expanded to include planned replacement for many key components before they begin to degrade in performance.

systems.[2] A second objective was to incorporate modern safety and security features in the warheads, which also added to the design complexity and the level of sophistication required to produce them. A third objective was to achieve operational flexibility in the stockpile. At the height of the Cold War, the United States had more than 50 different types of nuclear weapons in five force structure categories. This offered the president a wide range of options in the event that nuclear weapons would need to be used. For a list of these options, see Figure 2.2. As shown, the number of different weapon-types in the stockpile was larger than it is today. The weapons produced during this period were highly sophisticated with designs that pushed the technological envelope in every way. These weapons were designed with very little margin for error, meaning every component had to work independently and together exactly as specified for proper functioning of the weapon. The current U.S. nuclear stockpile is comprised of a subset of these weapons; all of the weapons in the current stockpile were developed and produced during the Cold War and are approaching or have exceeded their original planned life.

STRATEGIC, OFFENSIVE
- Intercontinental Ballistic Missiles*
- Strategic Heavy Bombers*
- Submarine-Launched Ballistic Missiles*

STRATEGIC, DEFENSIVE
- Air Defense Missiles
- Anti-Ballistic Missiles

TACTICAL, OFFENSIVE
- Dual-Capable Aircraft*
- Free-Flight Rockets
- Surface-Launched Ballistic Missiles
- Surface-Launched Cruise Missiles
- Artillery-Fired Atomic Projectiles

TACTICAL, DEFENSIVE
- Air Defense Missiles
- Atomic Demolition Munitions

TACTICAL, SEA
- Anti-Submarine Depth Bombs
- Air-Delivered Bombs
- Sea-Launched Cruise Missiles
- Torpedoes
- 16-inch Battleship Guns

* indicates currently existing U.S. nuclear weapon delivery vehicles

Figure 2.2 Cold War Nuclear Weapon Delivery Vehicles

In the period between the mid-1980s and early 1990s, U.S. stockpile management strategies shifted significantly. The end of the Cold War in the late 1980s coincided with the closure of the Rocky Flats production facility.[3] With the end of the Cold War, the United

[2] The first nuclear delivery system, the *Enola Gay*, was a specially modified long-range bomber. Since 1945, the United States has added intercontinental ballistic missiles (ICBMs) and submarine-launched ballistic missiles (SLBMs) to its force posture to achieve what is known as the "nuclear triad" for strategic systems. (For additional information on nuclear delivery systems, see Chapter 3: *U.S. Nuclear Forces*.)

[3] The Rocky Flats Plant in Colorado was the only U.S. facility that mass-produced plutonium fissile components (called "pits"). When the Rocky Flats Plant closed, the United States lost its capacity to mass produce pits. As recognized by the Nuclear Posture Review, reestablishing a pit production capability (including plutonium processing) and building a modern secondary production facility are necessary steps for the NNSA to achieve a modernized and responsive capacity to produce nuclear components for stockpile life extension. U.S. nuclear component production capability is extremely limited at the present time and has been almost non-existent since the end of the Cold War. When this

States adjusted its national security priorities and reconsidered the appropriate role for its nuclear weapons. In the early 1990s, there was a desire to realize the benefits of the "peace dividend," especially with reduced funding for nuclear weapons and nuclear forces. There was also an increasing awareness that nuclear proliferation and the possibility of a nuclear accident or nuclear terrorism was becoming the most urgent threat facing the United States and its allies. In response to these changing geopolitical circumstances, President H.W. Bush announced the immediate termination of additional nuclear weapons production in 1991 and a moratorium on nuclear testing that began in 1992 and has continued ever since. As a result, the nuclear weapons modernization and replacement model was abruptly terminated and replaced with a mandate for the indefinite retention of the weapons in the legacy stockpile without underground nuclear testing (UGT). To fulfill this mandate, stockpile management strategies evolved to maintain an established stockpile of aging weapons without UGT that were originally programmed to last no more than twenty years when supported with nuclear testing.

2.2.1 Stockpile Life Extension from 1992 - 2010

By 1992, when warhead production and UGT had ended, the designs of each type of weapon in the stockpile had been confirmed with nuclear testing, and U.S. nuclear scientists and engineers were very confident in both the designs and manufacturing processes that produced the weapons. Because of this confidence, the primary stockpile management strategy to ensure the continued safety, security, and reliability of U.S. nuclear weapons was to maintain the weapons in the U.S. stockpile (composed of weapons designed and built during the Cold War) as close as possible to their original designs and specifications. This has been achieved through stockpile refurbishment life extension programs (LEPs). During this period, each weapon-type in the enduring stockpile had LEPs planned as far into the future as practical, in many cases up to two decades. The LEP planning and the reductions in numbers associated with the various treaties led to a revised life-cycle for nuclear weapons. Figure 2.3 illustrates the U.S. approach to stockpile management during this time.

Refurbishment LEPs, which have been conducted since the 1990s, involve the use of existing or newly manufactured components that are based on the original designs specific

capability is achieved and there are plans in place to reconstitute U.S. nuclear component production, it will mark the beginning of a new stockpile support paradigm whereby the NNSA can meet stockpile requirements through its production infrastructure, rather than through the retention of a large inactive stockpile to support requirements. An important benefit of the re-creation of this capability will be the eventual reduction in the total number of warheads retained in the stockpile. For a more in-depth discussion of this subject, see Chapter 3: *U.S. Nuclear Forces*.

to that weapon. For refurbishment LEPs, nuclear and non-nuclear components are produced as closely as possible to the original designs for that warhead. Deviations from original designs generally occur only as a result of "sunset" technologies (where there are no longer technologies in existence to produce items) or manufacturing processes that cannot be replicated because of environmental or health hazards.

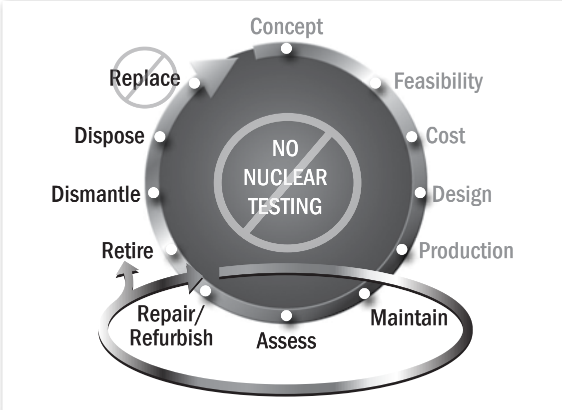

Figure 2.3
U.S. Approach to Stockpile Management, 1992-2010

There are two increasingly problematic issues with a refurbishment-only stockpile maintenance strategy. First, as a growing number of incremental changes are made to nuclear weapons through the refurbishment process, the further away from their original specifications the weapons become. Because these legacy weapons were built to push the envelope of the technologically possible in terms of achieving yield-to-weight ratios, very little margin for error exists, so any deviations from very exact specifications could negatively impact confidence in the performance of the weapon in all its aspects (safety, security, and reliable yield). As confidence degrades and uncertainty is introduced, it is increasingly difficult to certify that these weapons continue to meet safety, security, and yield standards.

> *Today, the United States has the technical capacity to produce safety and security features that are superior to those in the current warheads.*

The second major issue with a refurbishment-only approach to life extension is that refurbishment offers very little opportunity to enhance safety or security performance by introducing technological improvements that have been developed over the past twenty years. Currently fielded stockpile weapons have safety and security features that were developed in the 1970s and 1980s. Today, the United States has the technical capacity to produce safety and security features that are superior to those in the current warheads. The refurbishment LEP process does not allow for incorporating these more effective safety and security features without underground nuclear testing to ensure that they do not corrupt the functioning of other safety, security, and yield characteristics of the weapon.

2.2.2 The Advancement of Stockpile Life Extension

To take advantage of innovations in safety and security and to preclude the need to resume UGT, the Obama Administration has decided on, and the 2010 Nuclear Posture Review (NPR) Report reflects, a strategy to ensure the continued safety, security, and effectiveness (consistent with the congressionally mandated Stockpile Management Program) of the U.S. nuclear arsenal through the expansion of life extension options beyond a refurbishment-only approach. This expanded LEP approach seeks to:

- Address the issue of aging nuclear weapons;
- Prevent the need to resume underground nuclear testing; and
- Enhance the safety, security, and reliability of the weapons of the U.S. nuclear stockpile.

Every LEP involves the potential use of existing and newly manufactured nuclear and non-nuclear components. LEPs do not provide new military capabilities for warheads, nor do they support new military missions. LEPs do not, therefore, result in "new" warheads.[4]

The newly expanded life extension process includes three technical approaches:

- Refurbishment LEP approach: replaces aging or otherwise defective non-nuclear and/or nuclear components using the same design as in the originally fielded warhead. This is the approach that has been used since the end of UGT in the United States.
- Reuse LEP approach: replaces aging or otherwise defective nuclear components using a previously tested design from another type of weapon.[5]
- Replacement LEP approach: replaces aging or otherwise defective nuclear components using a previously tested design that had never been fielded in any U.S. weapon (but would not require UGT to certify).

The LEP strategy is based on the following principles:

- LEPs will only use nuclear components based on previously tested designs and will not support new military missions or provide for new military capabilities.

[4] A warhead is defined as "new" if the design of one or more of the nuclear components (within the nuclear explosive package—the pit or the secondary, either individually or together) was not previously produced or tested, nor based on previously tested designs. The use of newly manufactured non-nuclear components does not cause a nuclear weapon to be considered new.

[5] Both refurbishment and reuse LEPs may involve minor modifications to the nuclear components to ensure warhead safety, security, and reliable yield. Additionally, non-nuclear replacement components are routinely manufactured for use in warhead maintenance and stockpile sustainment.

- Each LEP will be certified—without underground nuclear testing—to ensure the weapons meet military requirements and safety and security standards.
- Each LEP will follow the established Phase 6.X Process and will consider all three approaches described above. (For more detailed information about the Phase 6.X Process, see Appendix D: *U.S. Nuclear Weapons Life-Cycle*.)
- The use of the third approach (use of a previously tested, but never-before-fielded, nuclear component design) requires presidential approval and congressional authorization.

2.3 Dual Agency Responsibility for Stockpile Management

The U.S. nuclear weapon stockpile is co-managed by the Departments of Defense and Energy. Because of the special nature of the weapons, the management process is very complicated. Stockpile management is governed by laws, Presidential Directives, and joint agreements. Additionally, both the DoD and the DOE have rules, processes, and documentation governing stockpile management, and neither department is bound by the internal rules and regulations of the other. To further complicate the process, the DoD and the DOE are appropriated funds to pay for nuclear weapon activities through different congressional committees. (For more information on the programming, planning, budget, and execution process, see Appendix I: *Programming, Planning, and Budgeting.*)

2.3.1 1953 Agreement

The responsibilities for nuclear weapons management and development were originally codified in the *Atomic Energy Act of 1946*, which reflected congressional desire for civilian control over the uses of atomic (nuclear) energy and established the Atomic Energy Commission (AEC) to manage the U.S. nuclear weapons program. Basic departmental responsibilities and the development process were specified in the *1953 Agreement Between the AEC and the DoD for the Development, Production, and Standardization of Atomic Weapons*, commonly known as the “1953 Agreement.”

In 1974, an administrative reorganization transformed the AEC into the Energy Research and Development Agency (ERDA). A subsequent reorganization in 1977 created the Department of Energy. At that time, the Defense Programs (DP) portion of the DOE assumed the responsibilities of the AEC/ERDA. In 1983, the DoD and the DOE signed a Memorandum of Understanding (MOU), *Objectives and Responsibilities for Joint Nuclear Weapon Activities*, providing greater detail for the interagency division of responsibilities. In

2000, the National Nuclear Security Administration was established as a semi-autonomous agency within the DOE responsible for the U.S. nuclear weapons complex and associated nonproliferation activities. Figure 2.4 illustrates the evolution of the AEC to the NNSA, and Figure 2.5 is a timeline of basic DoD-DOE nuclear-related agreements.

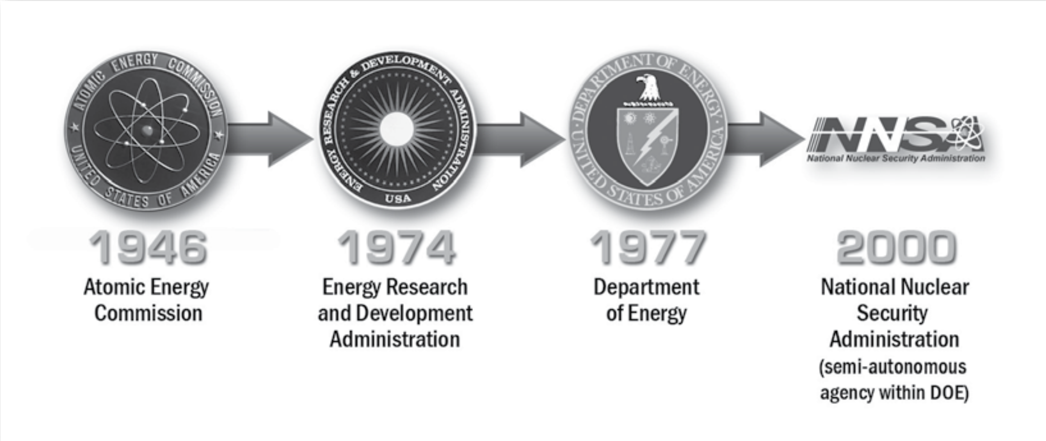

Figure 2.4 AEC to NNSA

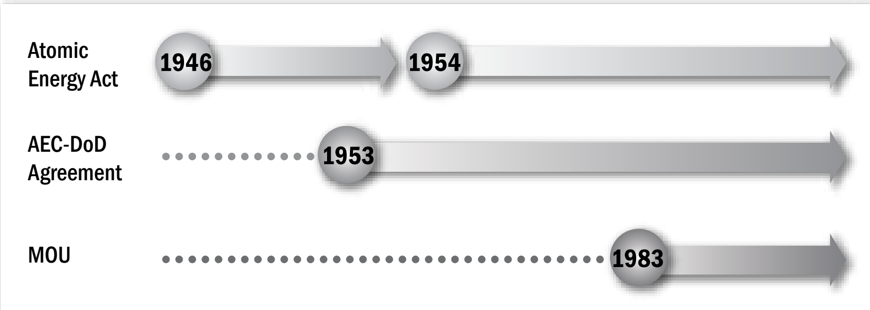

Figure 2.5 Timeline of DoD-DOE Nuclear-Related Agreements

While the fundamental dual-agency division of responsibilities for nuclear weapons has not changed significantly, the 1953 Agreement was supplemented in 1977 (to change the AEC to the ERDA), again in 1984 (to incorporate the details of the 1983 MOU), and most recently in 1988 (to incorporate the [then] newly established Nuclear Weapons Council (NWC)).

2.3.2 Departmental Responsibilities

Overall, the DOE is responsible for developing, producing, and maintaining nuclear weapons. The DoD is responsible for identifying the requirements that drive the retention of existing weapons and the need for modifications or additional weapons. It is also responsible for operational employment preparedness, security, accountability, and logistical maintenance of weapons in DoD custody.

Specifically, the DOE is responsible for: participating in authorized concept and feasibility studies; evaluating and selecting the baseline warhead design approach; determining the resources (funding, nuclear and non-nuclear materials, human capital, facilities, etc.) required for the program; performing development engineering to establish and refine the warhead design; engineering and establishing the required production lines; producing or acquiring required materials and components; assembling components and sub-assemblies into stockpile warheads (if approved by the president); providing secure transport within the United States; developing maintenance procedures and producing replacement limited-life components (LLCs) and replacement components for refurbishment; conducting a jointly approved quality assurance program; developing a life extension plan—when required—for sustaining the stockpile; securing warheads, components, and materials while at DOE facilities; accounting for individual warheads in DOE custody; participating in the joint nuclear weapons decision process; receiving and dismantling retired warheads; and disposing of components and materials from retired warheads.

The DoD is responsible for: participating in authorized concept and feasibility studies; developing requirements documents that specify operational characteristics for each warhead-type and the environments in which the warhead must perform or remain safe; participating in the coordination of the engineering interface requirements between the warhead and the delivery system; determining design acceptability; specifying military/national security requirements for specific quantities of warheads; receiving, transporting, storing, securing, maintaining, and (if directed by the president) employing fielded warheads; accounting for individual warheads in DoD custody; participating in the joint nuclear weapons decision process (including working groups, the warhead Project Officers Group (POG), the NWC Standing and Safety Committee (NWCSSC), and the NWC); developing and acquiring the delivery vehicle and launch platform for a warhead; and storing retired warheads awaiting dismantlement in accordance with jointly approved plans.

Both the Department of Defense and the Department of Energy rely primarily on the Nuclear Weapons Council to serve as a coordinating body for interagency activities associated with stockpile management.

The two organizations communicate through multiple channels, which ranges from direct interaction among personnel from the scientific and engineering communities and military operators to dialogue and activities among more senior officials and policy makers. Both the Department of Defense and the Department of Energy rely primarily on the Nuclear Weapons Council to serve as a coordinating body for interagency activities associated with stockpile management.

2.3.3 The Nuclear Weapons Council

The Nuclear Weapons Council serves as the focal point for interagency analyses and decisions to maintain and manage the U.S. nuclear weapons stockpile. The NWC is a joint Department of Defense and Department of Energy organization that was established to facilitate cooperation and coordination, reach consensus, and establish priorities between the two departments as they fulfill their dual-agency responsibilities for U.S. nuclear weapons stockpile management.

The NWC provides policy guidance and oversight of the nuclear stockpile management process to ensure high confidence in the safety, security, and reliability of U.S. nuclear weapons. It meets regularly to raise and resolve issues between the DoD and the DOE regarding concerns and strategies for stockpile management and is responsible for a number of annual reports that focus senior-level attention on important nuclear weapons issues. Specifically, the NWC is required to report regularly to the president regarding the safety and reliability of the U.S. stockpile as well as to provide an annual recommendation on the need to resume underground nuclear testing to preserve the credibility of the U.S. nuclear deterrent. The council is also obligated to evaluate the surety[6] of the stockpile and to report its findings to the president each year. The NWC, through its oversight and reporting functions, also ensures that any significant threats to the continued credibility of the U.S. nuclear capability will be identified quickly and resolved effectively. Figure 2.6 illustrates NWC membership as stated in Title 10, Section 179 of the U.S. Code. (For more information on the Nuclear Weapons Council and its subordinate bodies, see Appendix A: *Nuclear Weapons Council and Annual Reports*.)

2.4 Nuclear Weapon Development and Acquisition Policy

As long as nuclear weapons exist, the United States is committed to maintaining a safe, secure, and effective nuclear deterrent. Existing nuclear weapons have been maintained

[6] Nuclear weapons *surety* refers to the materiel, personnel, and procedures that contribute to the security, safety, and reliability of nuclear weapons and to the assurance that there will be no nuclear weapon accidents, incidents, unauthorized weapon detonations, or degradation in performance at the target. For more on surety, see Chapter 5: *Nuclear Safety and Security*.

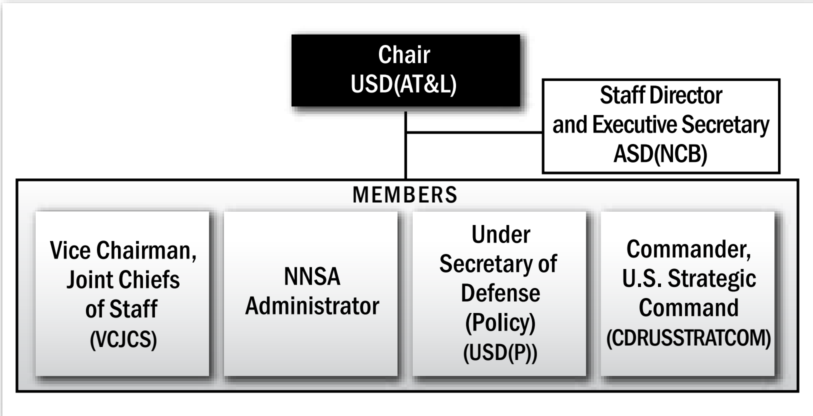

Figure 2.6 NWC Membership

well beyond their original programmed life. To ensure that these weapons remain safe, secure, and reliable, the Department of Defense and Department of Energy have developed several approaches for maintaining these weapons in an era of no nuclear testing. Until nuclear weapons are globally abolished, however, there exists a need for a nuclear weapon development and acquisition policy. The responsibility to provide forces and the acquisition of military capability rests solely with the Military Services.

2.4.1 Process Flow

The diagram in Figure 2.7 depicts the high-level process flow associated with the development and maintenance of nuclear weapons.[7] Presidential guidance, as promulgated through national documents like the 2010 Nuclear Posture Review Report, informs planning documents that Department of Defense combatant commanders use in the development of operational plans. In turn, these planning documents include requirements for capabilities and forces. These requirements create a demand for resources to ensure that the required capabilities are available to support combatant commanders. Resource requirements are consolidated and sent to the president for approval and submission into budget requests.

Figure 2.7 High-Level Process Flow

[7] This process also applies to life extension programs and major weapons modifications.

Nuclear weapons policy and strategy guidance originate from presidential direction. Each president has his own naming convention for these direction documents; in the recent past, presidents have used the terms National Security Directives (NSDs), Presidential Decision Directives (PDDs), and National Security Presidential Decisions (NSPDs). Currently, the president uses the term Presidential Policy Directives (PPDs). While the names may differ, the intent is the same—to provide national-level guidance on U.S. national security issues such as those related to nuclear weapons.

After guidance is promulgated by the president, the secretary of defense amplifies it before issuing it to the chairman of the Joint Chiefs of Staff (CJCS). These documents include the Defense Planning and Programming Guidance (DPPG) and various nuclear-related Department of Defense Directives (DoDDs).

Based on the detailed guidance and combatant commanders' general planning, nuclear weapons requirements are developed by the combatant commanders, the Military Services, and the Joint Staff. They are submitted to the Nuclear Weapons Council staff and combined with other inputs to inform the development of the Requirements & Planning Document (RPD). The RPD includes specific policies, military requirements, joint DoD-DOE planning factors, a long-range projection, and supporting programmatic details. The RPD is the basis for the draft presidential Nuclear Weapons Stockpile Plan (NWSP) that is submitted annually to the president with the Nuclear Weapons Stockpile Memorandum (NWSM), signed by the secretaries of defense and energy. When the president signs the associated Presidential Policy Directive, the NWSP becomes the presidential guidance that starts the process flow all over again.

This continuous cycle relies on the current combatant commanders' operational plans as a basis for the requirements analysis process. If necessary, requirements are modified based on the most recent detailed guidance. If the fielded weapons stockpile does not meet those requirements, the next version of the RPD, the NWSM, and the draft NWSP incorporates the necessary changes needed to ensure compliance. During the Cold War, the majority of requirements changes were made to gain increased weapon effectiveness, to achieve better weapon safety and security, and to increase weapons quantities. In recent years, changes to requirements have served to reduce weapons quantities. Because of the restriction on nuclear testing, there have not been any requirements associated with increasing effectiveness or achieving increased safety and security. If a required capability does not exist, the Services begin the acquisition process to provide the capability. If the required capability is a delivery platform, the Services use the Joint Capability Integration and Development System (JCIDS) process; if the requirement is a nuclear weapon, the interagency Joint Acquisition Process for Nuclear Weapons, more commonly known as the Phase Process, is used.

The Joint Capability Integration and Development System

JCIDS was established by the CJCS and the Joint Requirements Oversight Council (JROC) to identify, assess, and prioritize joint military capability needs. JCIDS is governed by DoDD 5000.01, *Defense Acquisition*; its scope includes major acquisitions or modifications, such as nuclear launch platforms (for example, strategic submarines) and delivery vehicles (for example, intercontinental ballistic missiles). The Military Services retain the responsibility for developing and acquiring the appropriate capability. JCIDS is an intra-DoD system operating among the Military Services and DoD Agencies; it does not operate in an interagency manner between the DoD and the DOE. The VCJCS leads the JROC in the JCIDS process. This “closes the loop” between the CJCS, the Combatant Commands, and the Military Services.

There are five phases in the JCIDs process: Phase 0, Concept Exploration and Definition; Phase I, Demonstration and Validation; Phase II, Engineering and Manufacture Development; Phase III, Production and Deployment; and Phase IV, Operation and Support.

The Joint Acquisition Process for Nuclear Weapons

The process for nuclear weapon acquisition has been in existence for over 55 years; the process, which covers the seven life-cycle phases of a nuclear weapon from concept to retirement, is often called the “Phase Process”. When the United States was developing and fielding new nuclear weapons, it relied on the Phase Process throughout the life-cycle of each weapon type. In the 1990s, the Phase Process was modified to accommodate the previously described system of weapons refurbishments. Today, the modified Phase Process is used to manage nuclear weapons programs. The NWC manages all aspects of nuclear weapons development in the Phase Process. (For more detailed information about the Phase Process, see Appendix D: *U.S. Nuclear Weapons Life-Cycle*.) In addition to the NWC, there are two other groups responsible for integrating the interagency acquisition of nuclear weapons: the NWCSSC and the POGs. The NWCSSC is a flag-level organization that executes and evaluates actions related to the U.S. nuclear stockpile for the NWC.

The POGs are joint DoD-DOE committees usually led by the Services that provide support for their assigned weapon-type; in addition to a POG for each weapon-type, there is also a use control POG. The POGs are chartered by the NWC and have representation from both the DoD and the NNSA. They coordinate and approve all activities associated with maintaining nuclear weapons in accordance with DoD and DOE requirements; for major actions on weapons (for example, life extension programs), the POGs collect information on the requirements and submit them to the NWCSSC and then the NWC for approval.

2.4.2 Acquisition Process Drivers

The nuclear weapons program is not static; various changes to nuclear weapons are routinely considered. In the past, new weapons capabilities were developed in response to requirements for increased military capability as a result of changing geopolitical circumstances or for a nuclear capability in a new delivery system, to attain greater military flexibility, or to incorporate newer and better safety or security features. As stated in the 2010 NPR Report, there are no current requirements for new warheads or new nuclear weapon capabilities.

Today, aging weapons components may require action in order to sustain the warhead's safety or reliability. These refurbishments could be in the form of a modification or an alteration. A modification, or Mod, is generally a change that impacts military operations, e.g., a change in logistical procedures for maintenance or transportation, or a change in weapon effects due to a change in yield or fuze functioning. An alteration, or Alt, is usually a replacement of an older component with a newer component that does not impact military operations, logistics, or maintenance. Alts are usually transparent to the military using units.

Aging components cause the majority of the problems and concerns that lead to requirements for Alts or Mods. These problems may be detected in a variety of ways, including through evaluations from non-nuclear flight and laboratory testing, observations made by field maintenance technicians, special laboratory surveillance of aging components, or changes to the delivery system requiring different electrical or mechanical interface between the warhead and the delivery vehicle.

2.5 Summary

Until 1992, U.S. stockpile management operated under a strategy of *modernize and replace*. With the moratorium on U.S. nuclear testing in 1992, the United States stopped producing new-design weapons, in part because the weapons could not be certified for safety or yield without a nuclear test. At that time, the stockpile management direction shifted to a strategy of *retain and maintain*. This change included adopting a life extension strategy using the basic life-cycle phase process to develop and field replacement components rather than new weapons. As the United States further reduces the nuclear stockpile on the path toward compliance with the New START, the nation continues to refine its strategy and policies to ensure that future life extension programs will provide a safe, secure, and reliable stockpile of nuclear weapons until effective and verifiable worldwide disarmament is achieved.