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Report to Congressional Requesters

May 2011

# NUCLEAR WEAPONS

# DOD and NNSA Need to Better Manage Scope of Future Refurbishments and Risks to Maintaining U.S. Commitments to NATO


GAO-11-387

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## DOD and NNSA Need to Better Manage Scope of Future Refurbishments and Risks to Maintaining U.S. Commitments to NATO

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Highlights

Highlights of GAO-11-387, a report to congressional requesters

### Why GAO Did This Study

U.S. nuclear weapons are aging, with key components reaching the end of their service life. In September 2008, the Department of Defense (DOD) and the National Nuclear Security Administration (NNSA) began a study of military requirements and design options for extending the B61 bomb's service life. The B61 is used to support the U.S. strategic deterrent and the North Atlantic Treaty Organization (NATO). GAO was asked to assess the extent to which DOD and NNSA have (1) considered the time available to begin producing refurbished bombs when determining the scope of the study; and (2) taken actions to avoid operational gaps in U.S. nuclear weapons commitments to NATO during the life extension program. To evaluate these objectives, GAO analyzed DOD and NNSA policies, guidance, and reports on life extension programs, and interviewed officials responsible for B61 operations, life extension program planning, management, and oversight. This is the unclassified version of a classified report issued in December 2010.

### What GAO Recommends

GAO is making recommendations that address the need to scope future requirements and design studies to reflect the time available to complete the program and prepare risk management plans to address operational concerns caused by potential life extension program delays. DOD and NNSA agreed with the recommendations.

View GAO-11-387 or key components. For more information, contact John Pendleton at (202) 512-3489 or pendletonj@gao.gov or Gene Aloise at (202) 512-3841 or aloisee@gao.gov.

### What GAO Found

DOD and NNSA have made progress in studying and updating the military's performance requirements for the B61 bomb and have ruled out some design options, but the broad scope of the study has complicated the effort, given the time available to begin producing refurbished bombs. Key components of the B61 bombs need to be replaced or they will begin reaching the end of their service life. However, the time and effort required to evaluate the broad scope, and other factors identified by DOD and NNSA officials, have prolonged the study by 1 year. Unlike prior life extension programs, the ongoing B61 study was broadly scoped to accomplish a variety of goals—such as considering previously untried design options and concepts—in addition to replacing the bomb's aging components. GAO's prior work on designing evaluative studies has shown that tailoring a study's scope to reflect relevant time constraints is a critical and well-established practice. However, the guidance for conducting life extension programs does not require DOD and NNSA to consider the available time when setting the scope for a life extension study. Because they have until September 2011 to complete the study, DOD and NNSA officials told GAO that it was premature to assess whether the study's broad scope put the life extension program at risk. However, future life extension programs are also likely to occur against the end of the existing warhead's service life. Unless DOD and NNSA clarify their procedures to require that future studies are properly scoped for the available time, they risk setting unrealistic goals and delaying future life extensions.

Although DOD and NNSA believe the B61 study will be completed by September 2011, they have not yet prepared a long-term risk management plan to help avoid operational gaps and ensure that the United States will be able to maintain the capability to support its NATO commitments if the B61 life extension program is delayed or canceled. The United States has pledged to support its nuclear weapons commitments to NATO while the B61 life extension program is under way. In light of this pledge, NNSA and DOD plan to perform just-in-time maintenance on the affected bombs to ensure they remain operational until NNSA can deliver refurbished bombs to DOD. However, avoiding an operational capability gap over the long term may prove challenging, as previous nuclear weapons life extension programs have experienced schedule delays for a variety of reasons. GAO's prior work has shown that a risk management plan is a useful tool for identifying and measuring risks, developing and implementing risk handling options, and assessing risk reduction measures. DOD and NNSA have identified potential steps that could be taken to mitigate operational risks if the B61 life extension program is delayed, but they have not prepared a plan to offer options for managing these risks. Developing such a plan would help ensure that DOD and NNSA are prepared to implement necessary measures to preserve U.S. commitments to NATO. Furthermore, without guidance requiring that DOD and NNSA prepare such risk management plans, operational requirements for other weapons could also be at risk as they go through future life extension programs.

# Contents

## Figures



### Abbreviations

| | |
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| DOD | Department of Defense |
| DOE | Department of Energy |
| ICBM | Intercontinental Ballistic Missile |
| NATO | North Atlantic Treaty Organization |
| NNSA | National Nuclear Security Administration |
| SHAPE | Supreme Headquarters Allied Powers Europe |
| SLBM | Submarine-Launched Ballistic Missile |
| USAFE | United States Air Forces in Europe |
| USEUCOM | United States European Command |

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**United States Government Accountability Office**
**Washington, DC 20548**

May 2, 2011

The Honorable Michael R. Turner
Chairman
Subcommittee on Strategic Forces
Committee on Armed Services
House of Representatives

The Honorable James R. Langevin
House of Representatives

Nuclear weapons have long been a cornerstone of the nation's defense strategy. These weapons—deployed on intercontinental ballistic missiles (ICBM), submarine-launched ballistic missiles (SLBM), heavy bombers, and fighter aircraft capable of performing nuclear missions—have played an essential role in deterring a nuclear attack on the United States and its allies and partners, including the North Atlantic Treaty Organization (NATO). At the same time, arms control agreements and other policies since the 1960s have led the United States to maintain its nuclear deterrent with decreasing numbers of weapons. In the April 2010 *Nuclear Posture Review Report*,[1] the current administration declared its commitment to further reducing U.S. nuclear forces, while maintaining a safe, secure, and effective nuclear deterrent for the United States and its allies, even as the weapons in the nuclear stockpile continue to age and weapon components reach the end of their operational life. Further, recognizing that NATO was undertaking a review of its Strategic Concept, which expresses the alliance's fundamental security tasks, the administration pledged in April 2010 not to prejudge NATO's review, even as it committed to retain the capability to forward deploy nuclear bombs.[2]

The Department of Defense (DOD) and the National Nuclear Security Administration (NNSA), a separately organized agency within the Department of Energy (DOE), are currently in the process of planning a

[1]Section 1070 of the National Defense Authorization Act for Fiscal Year 2008, Pub. L. No. 110-181 (2008), required the Secretary of Defense, in consultation with the Secretary of Energy and Secretary of State, to conduct a comprehensive review of the nuclear posture of the United States for the next 5 to 10 years. DOD published the conclusions and recommendations from that review in the April 2010 *Nuclear Posture Review Report*.

[2]On November 19, 2010, shortly after we received comments on our draft report, NATO members completed this review and adopted a new Strategic Concept.

life extension affecting four of the five versions of the B61 bomb.[3] The B61 bomb is one of seven types of nuclear weapons that remain in the U.S. stockpile. The bomb is used to support U.S. nuclear commitments to NATO, where, as part of NATO's forces, it is intended to signal cohesion among NATO members, and when deployed, versions of the bomb could be carried on U.S. and NATO fighter aircraft during conflict. DOD and NNSA have stated that the B61 life extension program is necessary because key bomb components will soon need replacement or the bombs would become nonoperational. Although Congress initially limited the scope and funding for the B61 life extension study to the bomb's nonnuclear components during fiscal year 2010, the April 2010 *Nuclear Posture Review Report* endorsed completing a "fullscope" life extension of the B61 bomb's nuclear and nonnuclear components.[4] In May 2010, as directed by Congress, DOE requested approval from the House and Senate Committees on Appropriations to study options for a fullscope life extension;[5] the fullscope life extension study was approved in August 2010.

The administration's continued commitment to extending the life of nuclear weapons is accompanied by requirements for significant investment in DOD delivery platforms and NNSA nuclear weapons production infrastructure. In a May 2010 report to Congress,[6] the administration identified a 10-year cost estimate of over $100 billion to sustain and modernize strategic delivery systems and U.S. dual-capable fighter aircraft. Additionally, NNSA has identified $80 billion in nuclear weapons stockpile and infrastructure costs over the same period to maintain the safety and reliability of the nuclear weapons stockpile without nuclear testing. Among other things, these infrastructure investments are to support not only the B61 life extension, but future life

[3]The planned life extension program covers the B61-3, B61-4, B61-7, and B61-10 versions, but does not cover the B61-11 version.

[4]A fullscope life extension would include the refurbishment of the bomb's nuclear components and nonnuclear components, whereas a limited life extension would include only the nonnuclear components.

[5]The Energy and Water Development and Related Agencies Appropriations Act, 2010, restricted NNSA from obligating or expending funds for "B61-12" nuclear components without prior approval of the Appropriations Committees. Pub. L. No. 111-85, 123 Stat. 2866 (2009).

[6]White House, *Report in Response to Fiscal Year 2010 National Defense Authorization Act Section 1251 New START Treaty Framework and Nuclear Force Structure Plans*, May 13, 2010.

extension programs for ICBM, SLBM, and bomber-delivered cruise missile warheads.

Our prior work has shown that nuclear weapons life extension programs can be complicated and risky endeavors that require disciplined management and effective collaboration among all the participating DOD and NNSA organizations. Although DOD and NNSA have improved management practices since our first report on NNSA's life extension programs was issued in 2000,[7] in March 2009, we reported that DOD and NNSA have continued to experience problems carrying out life extensions within the agreed-upon schedule, and within estimated costs.[8]

In March 2008 the Nuclear Weapons Council—a statutorily authorized joint activity composed of DOD and DOE officials—approved an Air Force request for a study of military performance requirements and potential design options for the B61 life extension program. As requested, we have reviewed the extent to which DOD and NNSA have (1) considered the time available to begin producing refurbished bombs when determining the scope of the study; and (2) taken actions to avoid operational gaps in U.S. nuclear weapons commitments to NATO during the B61 life extension program. In December 2010, we reported to you on the results of our work in a classified report. This is the unclassified version of that classified report. To prepare this unclassified version, we removed certain references to nuclear weapons quantities, storage locations, designs, and performance characteristics.

To evaluate our objectives, we analyzed DOD, DOE, and Nuclear Weapons Council policies and guidance on planning and carrying out nuclear stockpile life extension programs; and reviewed DOD and NNSA reports and B61 Project Officers Group status briefings on the B61 life extension program. We also interviewed DOD and NNSA officials responsible for coordinating the joint DOD-NNSA study of requirements and design options for the planned B61 life extension program, and other officials from the Office of the Secretary of Defense, Air Force, and NNSA, including the former NNSA manager for nuclear weapons stockpile sustainment, the current NNSA manager for the B61 weapon system, and

[7]GAO, *Nuclear Weapons: Improved Management Needed to Implement Stockpile Stewardship Program Effectively*, GAO-01-48 (Washington, D.C.: Dec. 14, 2000).

[8]GAO, *Nuclear Weapons: NNSA and DOD Need to More Effectively Manage the Stockpile Life Extension Program*, GAO-09-385 (Washington, D.C.: Mar. 2, 2009).

NNSA managers for ICBM, SLBM, and cruise missile weapon systems. We analyzed documents from the Office of the Secretary of Defense, NNSA, U.S. Strategic Command, U.S. European Command, and NATO and met with officials from these organizations. Our scope and methodology are described in more detail in appendix I.

We conducted this performance audit from October 2009 to December 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

## Background

Most modern nuclear weapons consist of three sets of components—a primary, a secondary, and a set of nonnuclear components enclosed in a case. When detonated, the primary and secondary components, which together are referred to as the weapon's "nuclear explosive package," produce the weapon's explosive force, or "yield." The array of nonnuclear components surrounding the nuclear explosive package serves to control the detonation sequence and helps ensure the weapon's safety and security from human tampering and accidental detonation. Some of these nonnuclear components—collectively called "limited-life components"—have shorter service lives than the weapon itself, and therefore must be periodically replaced.

The U.S. stockpile includes more than 5,000 nuclear weapons, the vast majority of which are either operationally deployed in the United States or on submarines at sea, or held in storage.[9] Based on guidance and direction provided by the President, Secretary of Defense, and Chairman of the Joint Chiefs of Staff, the Commander of U.S. Strategic Command is responsible for developing an operational plan and identifying targets for an arsenal that includes 1,700 to 2,200 operationally deployed strategic nuclear weapons. The Air Force maintains and operates nuclear-armed ICBMs,

[9]As of September 30, 2009, the U.S. stockpile totaled 5,113 warheads, including deployed weapons, spares, and warheads kept in reserve for operational crises or to replace weapons that have become unreliable due to aging or other defects. "Operationally deployed" weapons are those that are deployed on either ICBMs in their launchers or on SLBMs onboard submarines, and nuclear armaments loaded on bombers, or stored in weapons storage areas on bomber bases.

cruise missiles, and gravity bombs, whereas the Navy maintains and operates nuclear-armed SLBMs. The Commander of U.S. Strategic Command has operational command and control over these nuclear forces but only the President is authorized to direct the use of nuclear weapons.

In addition to the nuclear forces under U.S. Strategic Command's operational control, the United States retains a limited number of nonstrategic, or "tactical" B61 bombs in the nuclear weapons stockpile to support NATO commitments. These bombs are maintained in an operational configuration, and can be delivered by both U.S. fighter aircraft and aircraft of predesignated, trained, and certified NATO allies. The Commander of U.S. European Command also serves as the Supreme Allied Commander of European forces, and would exercise command and control of these weapons during a conflict. The Air Force exercises day-to-day custody of the B61 bombs used to support NATO commitments. As is the case for the employment of nuclear weapons under U.S. Strategic Command's control, only the President of the United States can authorize the NATO Supreme Allied Commander to employ the B61 bomb.

While U.S. Strategic Command has prepared an operational plan for employing nuclear weapons, neither NATO nor U.S. European Command, in accordance with the NATO Strategic Concept, have prepared standing peacetime nuclear contingency plans or identified targets involving nuclear weapons. The B61 bombs assigned to support NATO are intended to provide for the collective security of all its members. According to U.S. European Command officials, the B61 bombs couple U.S. and NATO security, and tangibly assure the members of NATO that the United States is committed to their national security. The April 2010 *Nuclear Posture Review Report* recognizes that the risk of nuclear attack against NATO members is at a historic low. However, the *Nuclear Posture Review Report* emphasized that NATO's unique arrangements, in which nonnuclear members participate in nuclear planning and possess specially configured aircraft capable of delivering nuclear weapons,[10] contribute to alliance cohesion and provide reassurance to allies and partners who feel exposed to regional threats.

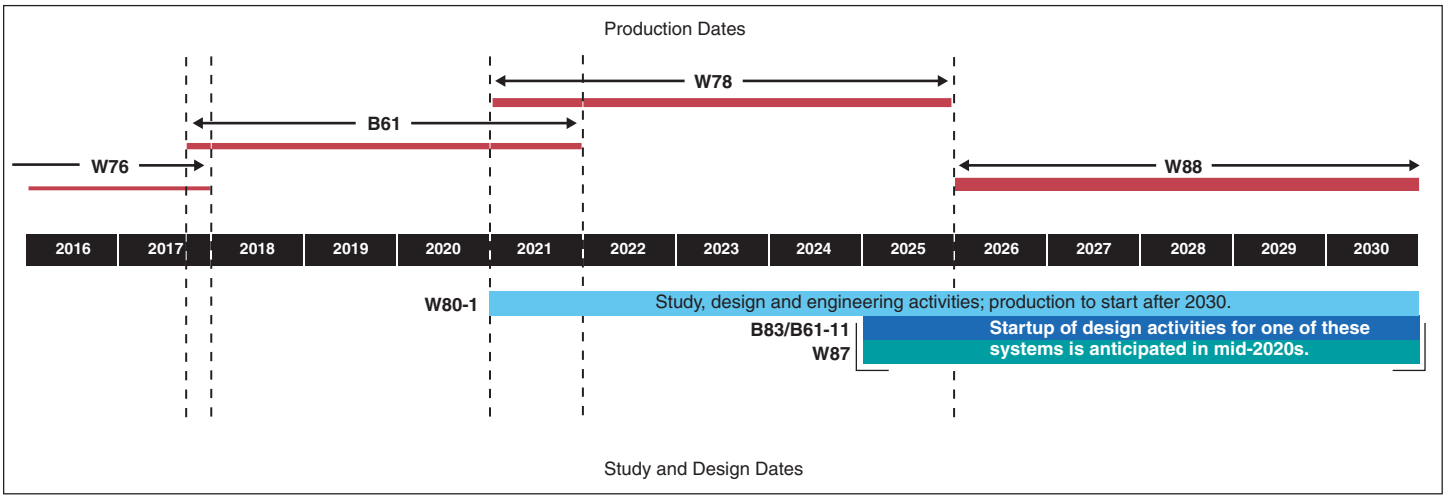
[10]Although NATO has no standing operational plans for the use of nuclear weapons, the United States and certain NATO allies provide forces and are required to maintain the ability to be on alert for nuclear operations within a 30-day, 180-day, or 365-day period.

The U.S. stockpile includes five different versions of the B61 bomb, which first entered the stockpile in the late 1970s and is the oldest weapon in the U.S. stockpile. Two of the five versions, considered "strategic" versions, would be carried into combat by B-52 and B-2 bomber aircraft, whereas the other three "nonstrategic" versions would be carried into combat by U.S. or NATO allied fighter aircraft. The five versions have different military characteristics, which identify key military performance requirements, such as safety requirements or explosive yield, for a given nuclear bomb or warhead. Furthermore, to protect against access by unauthorized persons, the nonstrategic versions were designed with advanced security systems.

To sustain the nuclear deterrent as weapons age, the current administration has endorsed a policy—also followed by prior administrations—to perform life extension programs on existing stockpiled weapons, rather than design, test, and produce new weapons. DOD and DOE both play crucial roles in planning and executing nuclear weapons life extension programs. DOE formally initiated the Stockpile Life Extension Program in 1996; NNSA has administered the program since fiscal year 2000. DOD and NNSA (or its predecessor DOE organizations) have previously planned and executed several nuclear weapons life extension programs and refurbishments, including life extensions of the W87 warhead, which is deployed on ICBMs, and the W76 warhead, which is deployed on SLBMs. NNSA also performed a significant refurbishment to the secondary component of the strategic versions of the B61 in the mid-2000s.[11] NNSA, due to limited production capacity, has conducted these life extension programs consecutively, rather than concurrently. Although their durations have varied, life extension programs can take nearly a decade or more from the start of the planning phases until refurbished weapons are delivered to DOD for reintroduction into the stockpile. The B61 life extension program and other planned life extension programs also are expected to occur sequentially, as shown in figure 1.

[11]We reviewed this refurbishment in our prior work. See GAO-09-385.

**Figure 1: Notional Life Extension Program Schedule, May 2010**




Source: NNSA.

NNSA and DOD use the "Phase 6.X" process to manage all nuclear weapons refurbishments, including not only alterations to fix or replace aging nuclear weapons components, but also fullscope life extension programs. The *Procedural Guideline for the Phase 6.X Process* establishes the joint process for nuclear weapons refurbishments.[12] After the Nuclear Weapons Council—the joint DOD and NNSA activity responsible for executive-level management of the nuclear weapons stockpile[13]—formally authorizes the beginning of a Phase 6.2 feasibility study for a life extension program,[14] a Service-led project officers group manages the study of design

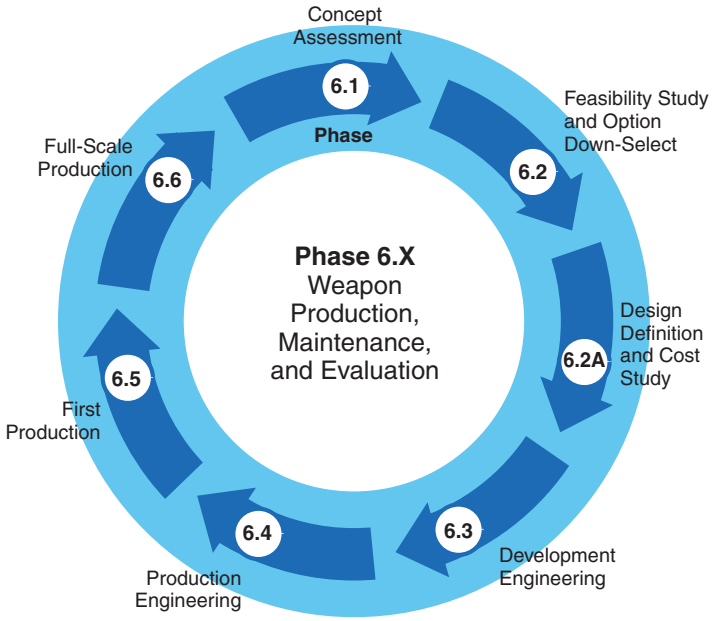
[12]Department of Defense and Department of Energy, *Procedural Guideline for the Phase 6.X Process* (Washington, D.C.: Apr. 19, 2000).

[13]The Nuclear Weapons Council membership includes the Under Secretary of Defense for Acquisition, Technology and Logistics (chair), the Under Secretary of Defense for Policy, the Vice Chairman of the Joint Chiefs of Staff, the Commander of U.S. Strategic Command, and the Under Secretary for Nuclear Security of the Department of Energy (dual-hatted as the Administrator of the National Nuclear Security Administration). 10 U.S.C. § 179.

[14]Although the Phase 6.X process begins with activities under Phase 6.1, DOD officials told us that life extension programs formally begin with a Phase 6.2 study authorization from the Nuclear Weapons Council, after weapons needing a life extension have been identified in Phase 6.1.

options for the weapon.[15] The steps for the Phase 6.X process are described in figure 2.

**Figure 2: DOD-DOE Phase 6.X Process for Managing Nuclear Weapons Refurbishments and Life Extension Programs**

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|---|---|
| 6.1 | DOD, NNSA, or the responsible project officers group conducts studies to determine if a weapon in the stockpile needs refurbishment or to investigate refurbishment concepts. |
| 6.2 | For a weapon needing refurbishment, the project officers group coordinates DOD and NNSA efforts to update the weapon's military requirements, develop feasible design options to meet the requirements, and identify a preferred design option(s). |
| 6.2A | The project officers group coordinates further DOD and NNSA investigation of a preferred design option(s) and the expected refurbishment costs. |
| 6.3 | NNSA-led tests and experiments to validate the design option(s) in consultation with DOD. |
| 6.4 | NNSA-led activities to adapt the design for production and prepare its production facilities. |
| 6.5 | Refurbishment of a limited number of weapons for analysis and production process qualification. |
| 6.6 | Full-scale production at NNSA's facilities. |

Source: Nuclear Weapons Council.

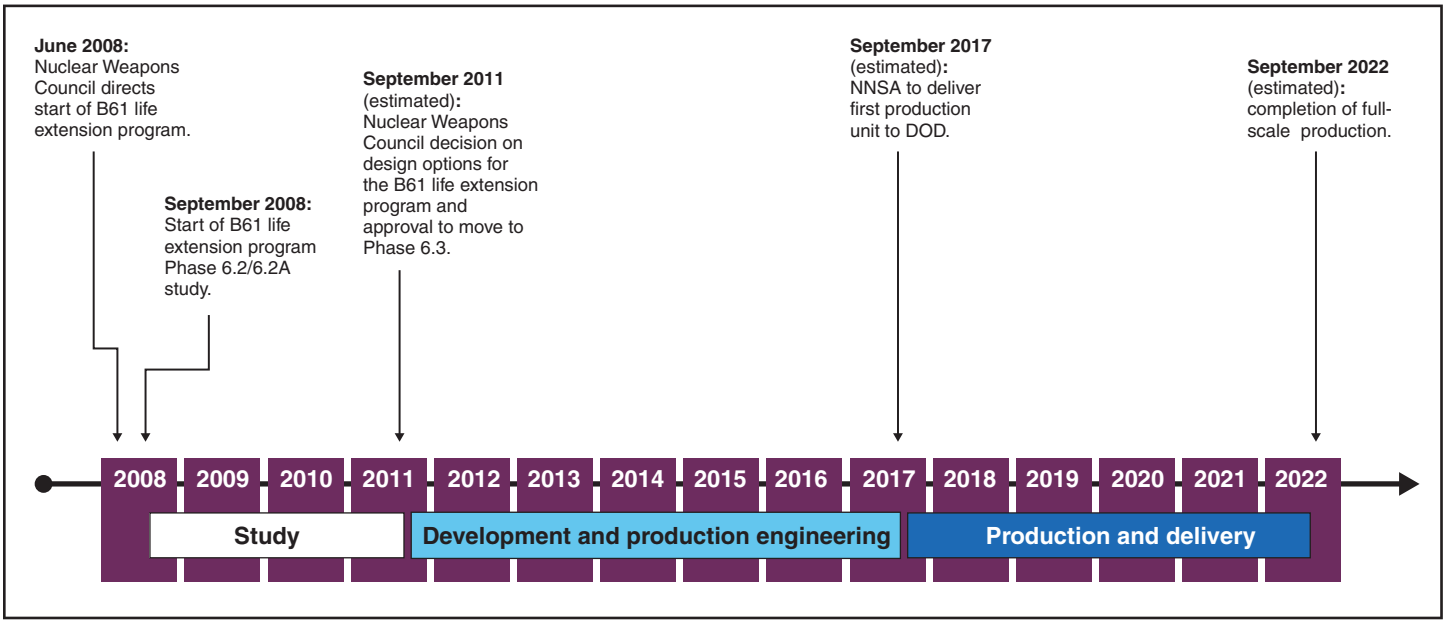
In March 2008, the Nuclear Weapons Council approved the Air Force's request for a study, under Phases 6.2 and 6.2A, to explore the feasibility and costs of conducting a fullscope life extension program of the B61 bomb.[16] In June 2008, the council directed the study to begin no later than September 2008 and be completed within 24 months; however, the study's

[15]A "project officers group" is a group of DOD and DOE personnel assigned to coordinate the development and compatibility assurance of a designated nuclear weapon system and its associated interfaces.

[16]The B61-11 entered the stockpile in the 1990s and was not included as part of the scope of the life extension program.

completion has been extended by 1 year.[17] As shown in figure 3, DOD and NNSA plan to deliver the first refurbished B61 bomb[18]—Phase 6.5 in the 6.X process—in 2017. According to the Air Force lead project officer for the B61 bomb, NNSA plans to produce enough refurbished bombs by the end of fiscal year 2022 to meet both U.S. Strategic Command's requirements and U.S. European Command's requirements to support NATO. The project officers group is seeking to extend the bomb's service life for another 30 years. According to the NNSA program manager for the B61 bomb, the preliminary cost estimate for the life extension program is about $4 billion through 2022, when the program would be completed.

**Figure 3: Key Dates in the Planning and Execution of the B61 Life Extension Program**




Source: GAO analysis of DOD information.

[17]According to the B61 Project Officers Group, the congressional direction to initially limit the scope of the study extended the time required to complete the study for a fullscope life extension program. In August 2010, the project officers group informed the Standing and Safety Committee that the study would be completed by September 2011.

[18]Although we recognize the distinctions among different life extension approaches that would "refurbish," "reuse," or "replace" nuclear weapons components, we use the expression "refurbished B61 bomb" throughout this report in a generalized way to distinguish the resulting B61 weapon from the existing versions currently in the stockpile, and the term "refurbishment" to refer to the B61 life extension program itself.

NNSA's Office of Defense Programs is primarily responsible for the B61 life extension program. This office plans and coordinates NNSA activities to maintain the nuclear stockpile, including the manufacture, maintenance, refurbishment, surveillance, and dismantlement of weapons; annual assessment of the weapons' safety and reliability; and research, development, and nonnuclear testing to support these activities. A national complex of three national nuclear weapons design laboratories, four production plants, and the Nevada National Security Site (formerly the Nevada Test Site) carries out the Office of Defense Programs' mission. For the B61 life extension program, Los Alamos National Laboratory, in New Mexico, and Sandia National Laboratory, in New Mexico and California, are directly involved in designing the refurbished B61; while Lawrence Livermore National Laboratory, in California, will peer-review the design. Once production has begun, NNSA's Pantex Plant, in Texas, will assemble key subcomponents of the refurbished bomb, including many of the nonnuclear components, manufactured at the Kansas City Plant, in Missouri, and, for a fullscope life extension, any nuclear components refurbished at other sites in the complex.

## The DOD-NNSA Review of B61 Performance Requirements and Design Options Is Progressing but the Review's Broad Scope Complicated the Study Efforts, Given the Available Time

Since initiating the joint study for the B61 life extension program at the request of the Nuclear Weapons Council in September 2008, DOD and NNSA have made progress evaluating the military's performance requirements for the refurbished B61 bomb and have ruled out key design options, but the broad scope of the council's request has complicated the joint study effort, given the time available to begin producing refurbished weapons. For example, the Nuclear Weapons Council, in its June 2008 letter, scoped the study to include options for incorporating previously untried technologies and design concepts into the refurbished bomb, in addition to replacing its aging components. As a result of the broad scope and other factors identified by DOD and NNSA officials, the study is expected to take until September 2011—1 year longer than initially planned. Our prior work on designing evaluative studies has shown that tailoring a study's scope to reflect the time constraints for conducting the study is a critical and well-established research practice.[19] Because the B61 Project Officers Group has made progress in the study, NNSA and DOD officials told us it was premature to assess whether the broad scope will affect their ability to begin producing refurbished B61 bombs by 2017. However, the complications raised by the B61 study's broad scope and

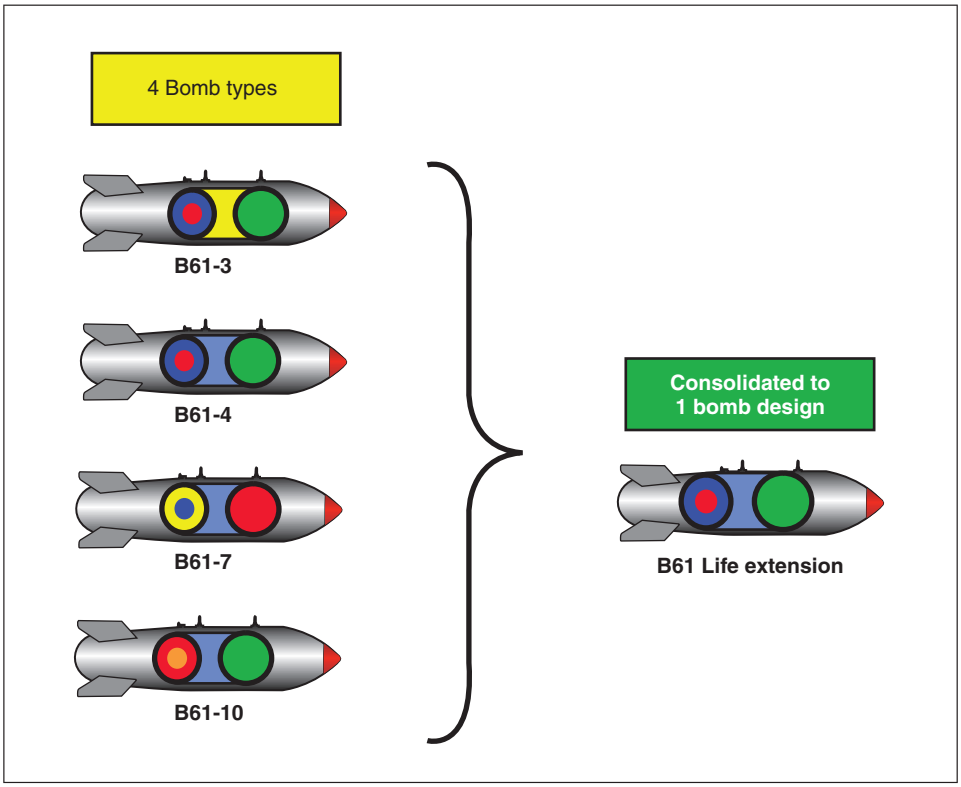
[19]GAO, *Designing Evaluations*, GAO/PEMD-10.1.4 (Washington, D.C.: May 1991).

limited time frame have implications for future life extension programs, because those programs also are likely to occur against the approaching end of the existing weapon's service life. Unless DOD and NNSA clarify their procedures to require that future life extension studies are properly scoped for the available time, they risk setting unrealistic goals and delaying future life extension programs.

## DOD and NNSA Have Made Progress Identifying Military Performance Requirements and Design Options for the B61 Life Extension Program

DOD and NNSA have reached a tentative agreement to consolidate several older versions of the B61 bomb into a single design. According to U.S. Strategic Command and NNSA officials, consolidating the versions could reduce the risks and costs of maintaining the bomb, improve the safety and security of the weapon, eliminate the need to conduct a life extension on multiple B61 versions, and reduce expenses by prolonging the interval for replacing key limited-life components. As a result of this agreement, as shown in figure 4, DOD plans to retire four versions of the B61 and replace them with a refurbished weapon based generally around the design of one of those versions, the B61-4. Because the B61-4 has the lowest yield among the different versions, consolidating the versions in this manner would also remove significant quantities of nuclear material from the deployed B61 bombs.

**Figure 4: Bomb Design Consolidation in the B61 Life Extension Program**




Source: U.S. Strategic Command.

Note: Figure is for illustrative purposes and does not accurately convey weapons design information or characterize differences among the B61-3/4/7/10 versions of the bomb. The B61-11 is not included as part of the scope of the B61 life extension program.

In agreeing to consolidate the B61 stockpile around a single design, DOD components—including U.S. Strategic Command, U.S. European Command, and the Air Force—reached agreement on some of the key performance requirements, or military characteristics, for the refurbished bomb. A nuclear weapon's military characteristics describe DOD's official requirements for the weapon's size, weight, and other physical attributes; performance characteristics, such as nuclear yields or heights-of-burst; safety and security standards, such as minimizing military personnel's radiation exposure; and other factors that affect nuclear weapons design. When conducting a Phase 6.2 study, NNSA officials told us that its design laboratories need DOD to reach agreement on its requirements early in the process so that they are able to assess the extent to which various design options for the life-extended weapon meet the military's needs.

The agreements reached to date have come about only through significant effort and time. For example, DOD required about 18 months from the beginning of the study to confirm NATO's requirements for the weapon. NATO's Supreme Headquarters, Allied Powers Europe (SHAPE),[20] originally submitted requirements for the refurbished B61 bomb in March 2009, 6 months after the study began. However, the Air Force lead project officer, and officials from U.S. European Command and SHAPE, told us that the original submission did not provide the B61 Project Officers Group with the specific requirements that it needed to conduct the Phase 6.2 study. In October 2009, the group asked DOD to clarify NATO requirements, and U.S. European Command led a DOD-wide effort throughout early 2010 to resolve key issues with certain NATO allies. In April 2010, DOD and the NATO allies reached agreement on key military characteristics of the bomb, including the yield, that it be capable of freefall (rather than parachute-retarded) delivery,[21] its accuracy requirements when used on modern aircraft and that it employ a guided tailkit section,[22] and that it have both midair and ground detonation options. They further agreed that the weapon should be capable of being carried by both existing and modernized fighter aircraft, including the F-35,[23] and be compatible with current weapon storage vaults abroad. Subsequently, after U.S. Strategic Command expressed a requirement for a different yield, U.S. European Command and SHAPE agreed to the proposal.

According to Air Force and NNSA officials, DOD's ability to reach agreement with the allies on these issues was a significant achievement. For example, had the allies opposed the guided tailkit, then the strategy to consolidate the different versions of the bomb may have been in jeopardy.

[20]The Supreme Headquarters, Allied Powers Europe, is the Headquarters of Allied Command Operations, one of NATO's two military commands, and is responsible for all alliance military operations.

[21]The currently deployed B61 bombs use a parachute to slow the bomb in midair and allow time for delivery aircraft to exit the targeted area before the bomb detonates.

[22]The guided tailkit section is a nonnuclear component that will replace the existing parachute and is intended to allow for increased aircraft survivability, safer delivery profiles, and more space for additional components, such as safety and security enhancements.

[23]The F-35 is the U.S. Air Force's next-generation fighter aircraft. The United States and other NATO allies are currently planning to use the F-35 for nuclear operations when it becomes available later this decade.

## Broad Scope and Tight Time Frames Have Complicated the Joint B61 Refurbishment Study

Although DOD and NNSA have made progress defining requirements and identifying design options for the B61, the Nuclear Weapons Council's June 2008 request was considerably broader than prior life extension programs and has complicated the agencies' effort, given the tight time frames for completing the study. Our prior work on designing evaluative studies has shown that tailoring a study's scope to reflect the time constraints for conducting the study is a critical and well-established research practice. Furthermore, the failure to align a study's scope with the time available can adversely affect the quality of the study.

The scope of the B61 study—which includes studying new features and designs, in addition to replacing aging components—is considerably broader than previous life extension programs. For example, the Nuclear Weapons Council requested the joint Navy and NNSA project officers group to only develop design options and cost estimates for refurbishing the W76 SLBM warhead,[24] which the Navy and NNSA concluded could be best accomplished by adhering as closely as possible to the weapon's original specifications.[25] Similarly, during the life extension of the W87 ICBM warhead, which was begun before DOD and DOE formalized the Phase 6.X process and completed in 2005, NNSA's actions were limited and not based on changes to the warhead's military requirements. However, for the current B61 life extension program, the Nuclear Weapons Council instructed the joint Air Force and NNSA project officers group that it should pursue not only the complete refurbishment of the bomb, but also opportunities to improve other characteristics affecting the bomb's safety, security, and performance, as well as investigate alternative design concepts untried during prior life extension programs. Table 1 compares the scope of the current B61 study with the scope of prior life extension programs and major refurbishments.

[24]Nuclear Weapons Council Standing and Safety Committee, Memorandum for Director, Strategic Systems Program Office, Subject: *W76/MK4 RBA Phase 6.2/6.2A Life Extension Study*, August 6, 1998.

[25]According to a Navy official, some improvements to the W76 warhead's safety and security features were also made during the refurbishment.

**Table 1: Scope of B61 Phase 6.2 Study Compared to Prior Nuclear Weapon Life Extension Programs and Major Refurbishments**

| Life extension program or refurbishment | Service | Scope | | |
|---|---|---|---|---|
| | | Refurbishment of aging components | Safety and security enhancements | Other enhancements or design changes |
| **Current life extension program** | | | | |
| B61 bomb, strategic and nonstrategic versions (B61-3, -4, -7, -10) | Air Force | Yes, many | Yes, many | Yes, many |
| **Prior life extensions or major refurbishments** | | | | |
| B61 bomb, strategic versions (B61-7, -11)[a] | Air Force | Yes | None | None |
| W80-1 cruise missile warhead[b] | Air Force | Yes | Yes | None |
| W76 SLBM warhead | Navy | Yes | None | None |
| W87 ICBM warhead[c] | Air Force | None | None | Yes |

Source: GAO analysis of DOD and NNSA data.

[a]The scope of this refurbishment included only the replacement of the nuclear secondary component in the strategic versions of the bomb.

[b]Safety and security enhancements were not originally part of the scope of the Phase 6.2 study for the W80-1 cruise missile warhead's life extension program. The W80 Project Officers Group first considered enhancements to the weapon's safety and security features after the Phase 6.2 study was under way, in response to a joint DOD and NNSA requirement that the W80 Project Officers Group consider opportunities for such enhancements. The life extension program, however, was canceled in May 2006 after DOD re-evaluated its cruise missile force structure requirements. According to a senior official from the Office of the Secretary of Defense, the life extension program may be resumed for the warhead after the Air Force assesses the requirements for long-range strike capabilities.

[c]The W87 refurbishment was initiated before DOD and DOE established the Phase 6.X process.

The broad scope of the B61 life extension program study also differs from prior life extension program studies in how it instructed the B61 Project Officers Group to review and address the weapon's key military performance requirements. Unlike the ongoing B61 life extension program study, prior programs did not require significant changes to the military performance requirements for the weapon being refurbished because these requirements were generally fixed by the type of delivery systems that carried them. For example, the W76 SLBM warhead and W80 cruise missile warhead life extension programs were intended to result in refurbished weapons carried by SLBMs and cruise missiles, respectively, and therefore the programs largely adhered to the military characteristics

associated with the original weapon.[26] In contrast, the Nuclear Weapons Council's June 2008 request letter instructed the B61 Project Officers Group to consider revisions to the bomb's military performance requirements in line with the aforementioned strategy to consolidate multiple B61 versions. As a result, the group has been working to consolidate the requirements for strategic and nonstrategic versions of the bomb, which currently have different requirements based on their mission. Also unlike prior programs, the B61 Project Officers Group also has been reviewing design options to ensure that the refurbished weapon will be able to be employed on existing and yet-to-be fielded aircraft—particularly the F-35. According to the Air Force official leading the requirements subgroup, consolidating the military performance requirements for the various versions of the bomb required considerably more time than previous life extension programs had taken to establish the refurbished weapons' military characteristics.

The B61 life extension program is also unique in that the stockpiled B61 bombs are approaching the end of their service lives, thus constraining the amount of time available to complete the study and the subsequent phases of the life extension program. The Nuclear Weapons Council recognized this urgency, when it emphasized, in the June 2008 letter, that the target date for production must ensure no capability gaps with respect to preserving U.S. nuclear weapons commitments to NATO, which would require NNSA to achieve Phase 6.5 (first production) no later than 2017. According to Air Force and NNSA officials, meeting this schedule will require the Air Force to perform maintenance on the existing weapons in order to give NNSA time to complete the life extension program before the weapons begin reaching the end of their service life. In contrast, prior life extension programs have not faced firm deadlines driven by end-of-life issues. For example, a senior Navy official told us that the Nuclear Weapons Council tasked the Navy and NNSA to begin the W76 life extension program study well before that weapon was expected to reach the end of its service life.

In addition to improving the bomb's safety and performance and reduce maintenance costs, the Nuclear Weapons Council had various other goals

[26]In the late 1990s, DOD and NNSA initiated a life extension program for the W80-1 cruise missile, which is designed for employment on air-launched cruise missiles. Although the W80 Project Officers Group completed the Phase 6.2 study for the life extension, and NNSA was preparing for production, the Nuclear Weapons Council canceled the effort in May 2006 after DOD re-evaluated its cruise missile force structure requirements.

in mind when it requested a broad scope for the B61 refurbishment study, according to DOD and NNSA officials. According to DOD officials, the B61 life extension offers a unique opportunity to implement national policy on safety and security of nuclear weapons.[27] In particular, Office of the Secretary of Defense officials told us that the council scoped the study broadly to provide opportunities to broaden the range of weapons-design and production activities being performed at the NNSA weapons complex. The council also wanted to potentially make use of the design innovations being developed at NNSA's nuclear design laboratories to improve the safety, security, and performance of aging weapons. Furthermore, in preparation for future life extension programs, the council wanted to take advantage of the B61 study to explore novel and innovative concepts that could be applied when conducting future life extension programs. As of September 2010, the B61 Project Officers Group had not yet reached agreement on some of the design options that were included in the scope of the study. The status of the review is summarized in table 2.

**Table 2: Status of Potential Design Options for the B61 Life Extension Program as of September 2010**

| Potential design option | Description | Risk | Status |
|---|---|---|---|
| Multipoint safety technology[a] | The June 2008 letter instructed the B61 Project Officers Group that it should explore options for enhancing the bomb's safety and security. | Has not been used in existing stockpiled weapons. | The B61 Project Officers Group is continuing its evaluation of costs and benefits of different multipoint safety technologies, including the potential impacts of different approaches on how the Air Force maintains and operates the weapons. |
| Alternative power supply components | Although the B61 bombs currently use a well-proven technology for power supplies, the B61 Project Officers Group studied alternative power supply technologies in order to potentially lower the bomb's overall costs. | The alternative technologies have not been used in the stockpile. NNSA estimates that the initial development and production costs of one of the technologies would be significantly greater than using the existing technology. | The B61 Project Officers Group ruled out one technology in August 2009. However, according to senior Air Force officials, the group had not yet determined whether the existing power supply technology is the most cost-effective approach for the refurbished bomb. |

[27]National Security Presidential Directive 28, issued in 2003, called for upgrading, where appropriate, safety and use control capabilities for all nuclear warheads during their refurbishment.

| Potential design option | Description | Risk | Status |
|---|---|---|---|
| Alternative bomb shapes | To create space for more safety and security features inside the tightly packed B61 bomb case, the council asked the B61 Project Officers Group to study alternative bomb bodies. In response, the group investigated the Mark-84 bomb shape and the Joint Standoff Weapon.[b] | Significant programmatic and design risks to incorporate alternative bomb shapes; did not meet the military's performance requirements. | The Joint Standoff Weapon was ruled out as a design option in April 2009, and the Mark-84 was ruled out in August 2009. |
| Alternative nuclear explosive components | Due to limitations in NNSA's capacity to manufacture new nuclear components, the council asked the B61 Project Officers Group to study options for reusing nuclear components from other weapons, in addition to reusing the B61 bomb's components. In particular, the group investigated reusing components from the W84 ground-launched cruise missile warhead.[c] | Significant programmatic and performance risks to adapt these components to a new weapon; did not meet the military's performance requirements; insufficient quantities to meet expected production requirements. | Ruled out as a design option in April 2009. |

Source: GAO analysis of DOD and NNSA data.

[a]"Multipoint safety" means that the probability is no greater than 1 in 1 million that a weapon will detonate with a yield of greater than 4 pounds of TNT if more than one point on the weapon's high explosive is accidentally detonated. Currently, all nuclear weapons in the U.S. stockpile are judged to be one-point safe.

[b]The Mark-84 is a 2,000-pound, unguided, conventional bomb. The Joint Standoff Weapon is a precision-guided, 1,000-pound air-to-surface conventional missile.

[c]Ground-launched cruise missiles were withdrawn from Europe beginning in the late 1980s. The W84 warheads, while not in the current U.S. stockpile, remain in a "managed retirement" status. Because they are a modern design, the warheads could be used as replacements for existing weapons, should those weapons develop performance problems.

Another factor complicating the B61 study is that the B61 Project Officers Group lacked the time to perform a formal concept assessment during Phase 6.1 of the Phase 6.X process. DOD and NNSA officials agreed that exploring novel design concepts would ideally occur before starting a Phase 6.2 study, consistent with the joint guidelines. Under the guidelines, either DOD or NNSA can begin a formal Phase 6.1 assessment to address a requirement change, or to study refurbishment options. Our prior work reviewing life extension programs also has concluded that, had NNSA taken the time needed to follow the Phase 6.X process during the earlier effort to refurbish components for the strategic versions of the B61 bomb, then the agency might have been better prepared to develop and test key materials that it had not manufactured in decades. However, in preparing for the ongoing B61 study, the B61 Project Officers Group lacked the time to perform a Phase 6.1 concept assessment, where requirements and design options could be more thoroughly explored, according to DOD and NNSA officials. As a result, the group required about 6 months to work

through issues that might have been addressed during a Phase 6.1 study, added the NNSA program manager for the B61 bomb.

## Broad Scope among the Factors That Prolonged the B61 Study

According to DOD and NNSA officials, the broad scope of the B61 study is one of several factors that have lengthened the time for completing the study. According to DOD and NNSA officials, the final study report is expected to be completed in September 2011, or 1 year later than the Nuclear Weapons Council's original deadline. DOD and NNSA officials told us that, while investigating these options, they were initially concerned that the broad scope would leave the B61 Project Officers Group without sufficient time or resources to select a preferred design option and develop more detailed cost information about that option. Prior GAO work on best practices for managing program costs has shown that poorly defining a program at the outset increases the risk that the program will fail to meet its cost, schedule, or operational goals.[28] According to DOD and NNSA members of the B61 Project Officers Group, absent the ability to rigorously define the military performance requirements and design options during the Phase 6.2 study, the later phases of the life extension program could be at risk. According to a March 2009 progress report from the B61 Project Officers Group, the scope of the study and progress made up to that point in time, among other factors, had put the study at risk of not meeting its deadline to produce the first refurbished B61 bombs in 2017. In August 2009, according to DOD and NNSA officials, the group was still considering multiple design options because of the broad scope, which made it difficult for it to investigate any particular option in greater detail.

Despite these delaying factors, members of the B61 Project Officers Group and other DOD and NNSA officials told us that they believe there is enough time remaining to complete the study and deliver the first refurbished bomb in fiscal year 2017, as noted by the Nuclear Weapons Council. Moreover, the officials added that factors aside from the Nuclear Weapons Council's broad scope also delayed progress in completing the study. First, according to DOD and NNSA officials, the B61 study was not fully funded during fiscal years 2009 and 2010. For example, the NNSA program manager for the B61 bomb stated that NNSA's fiscal year 2009 budget had already been submitted to Congress when the Nuclear

[28]GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: Mar. 2009).

Weapons Council authorized the B61 study; as a result, the NNSA had only about $28 million of a required $60 million for the study in fiscal year 2009. Additionally, the officials told us that Congress's prohibiting NNSA to obligate or expend funds during fiscal year 2010 for nuclear components for the refurbished B61 bomb without prior approval also delayed progress on the study.[29] For example, the NNSA program manager told us that the B61 Project Officers Group would have begun an investigation of the extent to which nuclear components from some versions of the bomb could be reused, had the congressional prohibitions not been in place. In its committee report accompanying the Energy and Water Development Appropriations Bill, 2010, the House of Representatives Committee on Appropriations recommended that no funds be appropriated for the B61 6.2/6.2A study in the absence of a clearly articulated strategy for the bomb.[30] With the lifting of this restriction and reprogramming of about $53.7 million to the program in August 2010,[31] however, an NNSA official told us that NNSA has developed a recovery plan to put the life extension program back on track to meet the 2017 deadline.

According to DOD and NNSA officials, the B61 Project Officers Group is responsible for completing the study and assessing the cost, schedule, and performance risk of the recommended design options to completing a fullscope life extension program and producing the initial refurbished weapons in 2017. The officials told us that, until the group completes its study and recommends particular design options to the Nuclear Weapons Council for approval, it would be premature to judge whether the scope of the study or other factors have placed the future phases of the life extension program at risk. However, the officials do acknowledge that, at the outset of the study, the scope of the effort was highly ambitious given the time that was originally allowed for completing the review.

[29]Pub. L. No. 111-85, 123 Stat. 2866 (2009).

[30]H.R. Rep. No. 111-203, at 129 (2009).

[31]Of this amount about, $39.6 million will support the B61 life extension study, and about $14.1 million will be used to replenish the stockpile systems account that was used to support the nonnuclear portions of the study.

## Future Life Extension Programs Could Be at Risk If Scope and Schedule Are Not Reconciled

The complications raised by the B61 study's broad scope and narrow time frames have implications for future life extension programs. Future life extension programs are likely to be increasingly complex. According to the April 2010 *Nuclear Posture Review Report*, every weapon currently in the stockpile will require some level of technical attention over the next 30 years to extend its service life. The *Nuclear Posture Review Report* also declared the administration's intention to study options for ensuring the safety, security, and reliability of the weapons on a case-by-case basis when planning future life extension programs, including whether to refurbish weapons components, reuse nuclear components from previously tested weapons or designs, or replace nuclear components with newly manufactured components. Adding to the complexity, the report added further the administration's intent, beginning with the planned W78 ICBM life extension program, to reduce the number of warhead types in the stockpile by considering the possibility of using refurbished warheads on multiple platforms.

Moreover, like the B61 life extension program, future life extension programs also are likely to occur against the approaching end of the existing warhead's service life. The W80-1 cruise missile warhead, for example, is expected to begin becoming nonoperable in about 2017 unless the Air Force replaces key limited-life components in the stockpiled weapons, according to the Air Force lead project officer for that weapon. Although NNSA expects to begin studying options for the W80-1 warhead life extension in the early 2020s, the Nuclear Weapons Council has not yet decided whether to authorize a life extension program for the warhead. Additionally, the Air Force is now leading a concept assessment for the W78 ICBM warhead so that the life extension program for the warhead could begin production as early as fiscal year 2020.[32] According to the Air Force, the W78 warhead life extension program is needed to meet ICBM operational requirements through 2030.

When faced with the approaching end of the B61 bomb's service life, the Nuclear Weapons Council was able to broadly scope the B61 study without fully reconciling it to the available time because it was not required to do so. In particular, the DOD-DOE *Procedural Guideline for the Phase 6.X Process* does not require the council to consider time

[32]Associate Air Force Chief of Staff for Strategic Deterrence and Nuclear Integration, Memorandum for Chairman, Nuclear Weapons Council Standing and Safety Committee, Subject: *W78 Life Extension Program Phase 6.1 Study*, August 18, 2010.

constraints when requesting a refurbishment study. Officials from the Office of the Secretary of Defense, the Air Force, and NNSA agreed that the joint Phase 6.X process guidelines should be updated to require that the scope of future Phase 6.2 studies reflect time constraints for conducting the study. For example, DOD officials told us that although the planned concept assessment for the W78 ICBM life extension program is expected to help clarify and narrow the scope of the requirements and design options that would be evaluated during the subsequent Phase 6.2 review, the underlying guidance for implementing the Phase 6.X process gives the Nuclear Weapons Council the flexibility to scope the Phase 6.2 study as its members see fit. Unless DOD and DOE clarify their procedures to require that future life extension studies are properly scoped given available time, they may set unrealistic goals for future life extension programs and raise the risk of delay.

## DOD and NNSA Have Not Planned for Maintaining Operational Nuclear Weapons Commitments to NATO if the B61 Life Extension Program Is Delayed

Although DOD and NNSA expect the B61 study to be completed by September 2011, a life extension program delay could affect the U.S. pledge to maintain operational nuclear weapons to support its NATO commitments. However, DOD and NNSA have not yet prepared a long-term risk management plan to help ensure that the United States will be able to maintain these commitments should such delays occur. In the *Nuclear Posture Review Report* and in remarks to NATO allies, DOD has committed to avoid a gap in its nuclear weapons capability for NATO while the B61 bomb's fullscope life extension is under way. However, meeting this commitment may prove challenging, as previous nuclear weapons life extension programs have experienced schedule delays for a variety of reasons. Our prior work has shown that developing a risk management plan is a useful program management tool for identifying and measuring risks, developing and implementing risk handling options, and assessing risk reduction measures.[33] NNSA has developed a risk management plan designed to keep the life extension program on schedule, and NNSA and DOD have developed some risk management measures that address near-term operational capability risks. However, they have not developed a long-term plan to offer options for preserving the ability to maintain the U.S. commitments to NATO if the life extension program is delayed or canceled. Developing such a plan would help ensure

[33]GAO, *Homeland Defense: Greater Focus on Analysis of Alternatives and Threats Needed to Improve DOD's Strategic Nuclear Weapons Security*, GAO-09-828 (Washington, D.C.: Sept. 18, 2009).

that DOD and NNSA are prepared to take the measures necessary to maintain these commitments during the B61 life extension. Furthermore, without guidance requiring that DOD and NNSA prepare such risk management plans, operational requirements for other weapons could also be at risk as they go through life extension programs, because these weapons are also reaching the end of their operational life.

## The United States Has Pledged to Avoid a Capability Gap in Its NATO Commitments

Recognizing the B61 bomb's importance to NATO security, United States officials have stated they will complete the B61 life extension program while maintaining the U.S. commitment to NATO. Under National Security Presidential Directive 35, the President establishes the number and type of weapons the U.S. commits to NATO. The United States has demonstrated its commitment to preserving this capability in a variety of ways. In 2008, the Nuclear Weapon Council stated that the first production target date for the B61 life extension—Phase 6.5 in the Phase 6.X process—must ensure that no gap in capability occurs with respect to this commitment. In the unclassified April 2010 *Nuclear Posture Review Report*, DOD pledged that the B61 life extension program would ensure the U.S. capability to deploy these weapons in support of NATO commitments, and that the program would enhance the bomb's safety and security features in order to maintain the allies' confidence in the U.S. deterrent. Further, in June 2010, the Secretary of Defense stated to NATO's senior nuclear decision-making body that the United States was committed to supporting the current and future NATO nuclear weapons requirements during the B61 life extension program. Given these commitments, a senior official from the Office of the Secretary of Defense told us that failing to perform the B61 life extension on schedule could create significant doubt among some NATO allies regarding the U.S. intentions to preserve its nuclear security guarantees.

While NATO is currently reviewing its reliance on nuclear weapons, officials from DOD and NATO do not expect the alliance to change its nuclear weapons requirements in the short term.[34] U.S. policy emphasizes that change to NATO's nuclear weapons requirements should be made

[34]In November 2010, as we were preparing to publish the classified version of this report, NATO completed its review and published a new Strategic Concept. Regarding NATO's nuclear posture, the revised strategic concept states that deterrence, based on an appropriate mix of nuclear and conventional capabilities, remains a core element of NATO's overall strategy and that as long as nuclear weapons exist, NATO will remain a nuclear alliance. See NATO, *Active Engagement, Modern Defense: Strategic Concept for the Defense and Security of the Members of the North Atlantic Treaty Organization*, Adopted by the Heads of State and Government in Lisbon (Nov. 2010).

based on a thorough review by the alliance and by consensus among NATO's 28 members. In November 2010, the NATO Secretary General is expected to provide NATO leaders with a revision to *The Alliance's Strategic Concept*, which was last published in 1999.[35] Given their expectation that NATO members will approve the revised Strategic Concept only by consensus, DOD and NATO officials told us that they believe the alliance will continue to rely on U.S. nuclear weapons commitments to maintain alliance cohesion for several reasons. First, the U.S. Secretary of State said in April 2010, shortly after the *Nuclear Posture Review Report's* publication, that NATO's review should be guided by the principles that NATO will remain a nuclear alliance for as long as nuclear weapons exist and, as a nuclear alliance, sharing nuclear risks and responsibilities widely among members is fundamental.[36] Second, the officials told us they believed that some NATO members, who joined the alliance since the Strategic Concept was last updated, were unlikely to seek changes to NATO's nuclear requirements, because they joined the alliance specifically because of strong U.S. security guarantees. Third, like the U.S. Secretary of State, a group of experts from 12 NATO members—convened by NATO to help revise the Strategic Concept[37]—recommended that NATO should continue to maintain secure and reliable nuclear weapons capabilities with widely shared responsibility at the minimum level required by the prevailing security environment. Although officials from DOD and NATO told us that they believed that NATO could consider altering specifics about its nuclear posture after the Strategic Concept was completed, they stated that the basic requirement for the United States to retain the capability to deploy nuclear weapons in support of NATO was likely to endure, even if NATO changes its policy.

[35]NATO, *The Alliance's Strategic Concept*, Approved by the Heads of State and Government participating in the meeting of the North Atlantic Council in Washington, D.C. (Apr. 1999).

[36]*Five Points on NATO Nuclear for the Secretary's Intervention at Tallinn*, Apr. 22, 2010, Tallinn, Estonia.

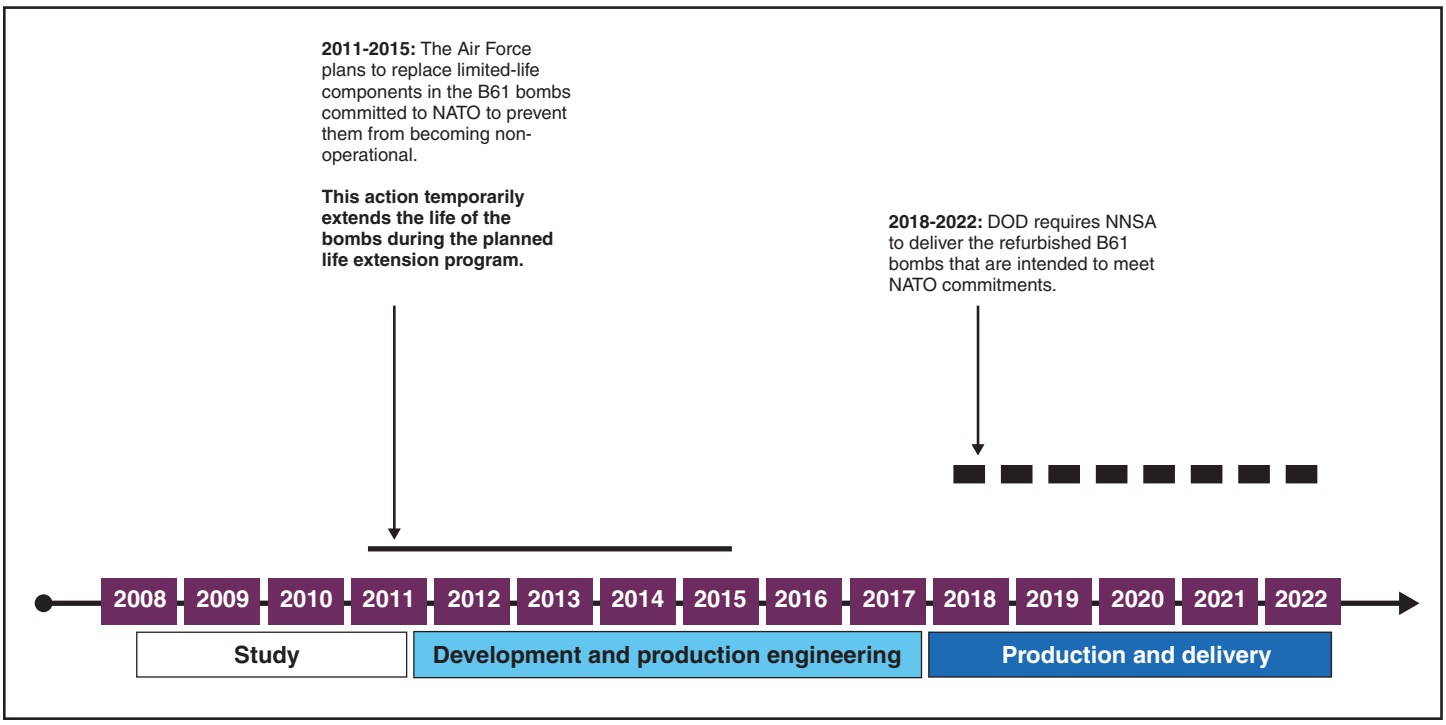
[37]NATO, *NATO 2020: Assured Security; Dynamic Engagement*, Analysis and Recommendations of the Group of Experts on a New Strategic Concept for NATO, May 17, 2010.

## DOD and NNSA Have Plans to Preserve Operational Requirements over the Short Term

In light of these commitments, both DOD and NNSA plan to take steps to ensure that the nuclear weapons committed to NATO remain operational while the B61 life extension program progresses. These steps include just-in-time maintenance actions on the existing bombs because critical components are expected to soon begin reaching the end of their service lives.[38] As shown in figure 5, DOD requires NNSA to deliver refurbished B61 bombs to meet its NATO commitments in 2018. To extend the operational life of the bombs committed to NATO for a few years while the life extension program is ongoing, the Air Force plans to replace key components—neutron generators and power supplies—with newer components removed from bombs that are no longer in the active stockpile. NNSA is supporting this effort by inspecting the components that are to be reintroduced to the weapons and by designing and manufacturing the containers, tooling, and related hardware needed to retrofit the deployed bombs.

[38]In contrast, the strategic B61-7 version of the bomb faces end-of-life issues later.

**Figure 5: Key Operational Dates for the B61 Bombs during the Life Extension Program**




Source: GAO analysis of DOD information.

In addition to these planned maintenance actions, NNSA has drafted a risk management plan to help ensure that the life extension program meets its milestones.[39] The plan, which includes the generally accepted elements of a risk management approach,[40] is focused on managing the cost, schedule, and performance risks to help ensure that the program is completed on time and within expected costs. The NNSA project manager for the B61 bomb told us that the plan will be updated as the B61 life extension program moves through the Phase 6.X process. Successfully executing this risk management plan is intended to avoid the operational consequences caused by delays to the life extension program, according to the B61

[39]NNSA, *B61 Life Extension Project Risk Management Plan* (Albuquerque, New Mexico: Dec. 10, 2008).

[40]The five elements of a risk management approach are: setting strategic goals, objectives, and determining constraints; assessing risk; evaluating alternatives for addressing risks; selecting alternatives; and implementation and monitoring. See GAO-09-828.

bomb's project manager, because the NNSA plan would minimize these delays.

NNSA also may design the refurbished B61 bomb so that some types of limited-life components could be used both on the existing weapons and on the newer version. In particular, the Air Force lead project officer and NNSA program manager for the B61 bomb stated that NNSA could produce neutron generators that could be used in both the existing versions that support NATO, and in the refurbished B61 bomb. According to NNSA's project manager for SLBM warheads, NNSA followed a similar strategy when it was unable to meet the Navy's production requirements during the W76 life extension program; in that instance, NNSA produced new neutron generators and took another nonnuclear component out of its reserve inventory for the Navy to install in existing W76 SLBM warheads. Similarly, if appropriate neutron generators are produced and available during the B61 life extension program, then they could be installed in the older bombs before the existing components reach the end of their service life. However, the B61 project manager also told us that the B61 Project Officers Group has yet to determine whether power supply requirements for the refurbished weapon will be significantly different from the existing weapons' requirements; such requirements would depend on other weapons-design issues that have yet to be settled, according to the official. Moreover, NNSA would have to initiate a new production line for the power supply components used in the older bombs, because unlike neutron generators, NNSA currently is not manufacturing these components. Given the complexity of the B61 life extension program compared to the W76 life extension program, it is not clear that NNSA will design components that could be easily used in both the new and old weapons.

## Key Factors Challenge the Commitment to Preserve Operational Nuclear Weapons Capability during the Life Extension Program

Even as DOD has plans to preserve the U.S. operational capability while the life extension program moves forward, preserving this capability in the event that the B61 life extension program is delayed could prove challenging, given the complexity of the task and the tight time lines for completing the program. Nuclear weapons life extensions are by their nature complex technical endeavors, and the B61 life extension program has a broader scope than prior life extensions. According to DOD and NNSA officials, the B61 life extension is the most complex life extension effort undertaken by NNSA to date. The effort involves replacing three times as many aging components as the W76 SLBM warhead life extension program, and NNSA has less time to complete the program, according to DOD and NNSA officials. The B61 life extension program is expected to

produce far fewer weapons than did the W76 life extension program; however, NNSA has less time—8 years—from the start of the Phase 6.2 study to produce the first refurbished B61 bomb, than the 10 years that NNSA required to produce the first refurbished W76 SLBM warhead. According to the B61 Project Officers Group, this development schedule is aggressive.

Potentially, the B61 life extension program will face key challenges, several of which have delayed prior life extension programs. These include potential challenges in manufacturing critical materials and components; difficulties in meeting production requirements; problems with the quality of finished weapons; and coordinating the production of bomb components with the Air Force. Because the B61 bomb is approaching the end of its operational life during its life extension program, the consequences of delays caused by these or other challenges could have a greater impact on the weapons' operational availability than they had during prior life extension programs.

- **Challenges in manufacturing critical materials and components:** NNSA could experience challenges in producing key materials and components, as it has in prior life extension programs. The W76 SLBM warhead life extension program experienced a yearlong delay when NNSA determined that it lacked the knowledge, expertise, and facilities to produce a key material required for the refurbished warhead. Also, as we found in our prior work,[41] NNSA experienced significant technical challenges when refurbishing secondary components in the strategic models of the B61, when testing revealed that NNSA was unable to reuse a critical material as planned because it did not function under certain conditions. Similar infrastructure-related issues could affect the B61 life extension program as well, according to NNSA officials. In particular, NNSA's construction of a new Kansas City Plant could present challenges for certain production activities in support of the B61 life extension program. The current Kansas City Plant, which was built in 1943, supplies about 85 percent of the nonnuclear components that compose a typical nuclear weapon, including those used in the B61. The transition from the old plant to the modern facility is scheduled to occur during fiscal years 2013 and 2014 at the same time the B61 life extension program will be conducting preproduction activities that support the life extension program. According to NNSA program officials, this means that some

[41] GAO-09-385.

of the preproduction activities may have to be conducted at the old plant, then continued after the new plant is operating. In 2009, we reported that the program to replace the Kansas City Plant had already been delayed by 1 year.[42] If the plant's modernization schedule is delayed further, then there could be a risk to completing the first refurbished B61 bomb in 2017, according to NNSA officials. However, the NNSA officials added that the risks can be managed by thorough planning.

- **Difficulties in meeting production requirements:** As it has in past life extension programs, NNSA may have difficulty meeting production requirements to deliver refurbished B61 bombs to DOD on time. For example, NNSA and Navy officials involved in the W76 SLBM warhead life extension program told us that NNSA was unable to meet the Navy's production requirements for refurbished W76 warheads; the Navy official explained that funding shortfalls left NNSA unable to purchase certain components, obtain necessary tooling, or hire more technical personnel needed to increase production rates. Regarding the B61 life extension program, after NNSA achieves first production in 2017—Phase 6.5 in the Phase 6.X process—the agency will require additional time to increase its weapons production rate in order to produce enough weapons suitable for delivery to DOD beginning in fiscal year 2018. However, as of August 2010 DOD and NNSA officials were uncertain that NNSA could meet the production rate required to meet NATO commitments given the time available to do so. Principally, NNSA has not determined how long it will take to achieve a full rate of production after reaching Phase 6.5, because the agency has not yet finalized the designs for key components that it would have to produce, according to NNSA and Air Force officials. Additionally, the NNSA program manager for the B61 bomb told us that he did not yet know whether NNSA was capable of producing enough weapons in time to meet not only DOD's operational requirements, but also NNSA's requirement to produce additional weapons for surveillance testing. The NNSA official added that DOD established its operational requirements and deadlines without considering NNSA's need to produce such weapons. However, DOD officials told us simply that DOD and NNSA have not been able to come to an agreement on projected out-year production requirements.

[42]GAO, *Nuclear Weapons: National Nuclear Security Administration Needs to Better Manage Risks Associated with Modernization of Its Kansas City Plant*, GAO-10-115 (Washington, D.C.: Oct. 23, 2009).

- **Problems with the quality of finished weapons:** Even as the need to produce weapons for quality assurance testing could pose challenges, the B61 life extension program also could face delays because of problems with the finished weapons that are discovered when NNSA performs surveillance tests. DOD officials have emphasized the importance of a surveillance testing program to ensure that newly refurbished bombs and warheads are reliable. In the past, NNSA has detected problems resulting from NNSA's manufacturing processes in finished warheads resulting in delivery delays to DOD.

- **Coordinating the production of bomb components between NNSA and the Air Force:** Uncertainty exists that the B61 life extension program will be completed on time because doing so will require NNSA and the Air Force to synchronize the production of different components of the bomb. While NNSA is responsible for refurbishing the bomb's nuclear and many of its nonnuclear components, the Air Force is responsible for acquiring a new guided tailkit section for the refurbished B61. The new bomb tail section is estimated to cost $800 million and is designed to increase accuracy, enabling the military to achieve the same effects as the older bomb, but with lower nuclear yield. The addition of the new tail section also allows NNSA to consolidate the different versions of the B61 bomb into a single version. Delivery of the refurbished B61 bombs with the new tail section is essential to meeting DOD's initial operating requirements to support NATO commitments. The Air Force is studying the requirements for the new tail section concurrently with the B61 study, and officials told us that the Air Force included funding in its budget request for fiscal year 2011. However, if the Air Force does not receive adequate funds, or the program is canceled altogether, NNSA would have to use a less sophisticated tail design in order to produce the first refurbished weapon in 2017. If the new tail is only delayed, and not canceled, then it could be fitted to the already-refurbished bombs at a later time, according to NNSA officials; however, this would involve increased cost and logistics efforts.

## DOD and NNSA Have Not Established a Long-Term Plan to Avoid Operational Capability Gaps If the B61 Life Extension Program Is Delayed

Although Air Force and NNSA officials told us that DOD's planned measures should mitigate the risk of a capability gap in the U.S. commitments to NATO during the B61 life extension program, DOD and NNSA have not established a plan to mitigate the long-term operational risks to these commitments, should the program be delayed. Our prior work shows that risk management is a useful tool that integrates a systematic concern for risk into the cycles of decision making.[43] Risk management principles help organizations to manage risk by assessing current threats and vulnerabilities; evaluating, selecting, and implementing risk reduction actions; and monitoring their implementation.

DOD and NNSA officials told us that there are several options that could be taken to manage the long-term risks to U.S. operational commitments. As of September 2010, the official program of record was for NNSA to develop options for a fullscope, 30-year life extension of the B61 bomb's nuclear and nonnuclear components, as requested by the Nuclear Weapons Council in June 2008. However, if the B61 Project Officers Group determines that the fullscope life extension is too high risk, it could recommend a more limited refurbishment, involving the bomb's nonnuclear components and communications systems, according to the Air Force's B61 lead project officer and other DOD and NNSA officials. The officials told us that while this option would extend the operational life of the B61 for several years, it would involve significant drawbacks. According to the Air Force lead project officer for the B61 bomb, the bomb would require continued patchwork maintenance to ensure the bomb's performance, safety, and security, even after NNSA completed the more limited refurbishment. Additionally, the NNSA would be unable to address the enhanced safety and security goals established for the program without making more extensive changes to the weapon's design than the limited refurbishment would allow. Moreover, according to NNSA, the bomb would require a second life extension program beginning in the mid 2020s; together, NNSA estimates that performing two life extension programs would cost roughly $2 billion more than the currently planned program. Moreover, because other nuclear weapons are expected to require refurbishment throughout the 2020s, NNSA officials told us that NNSA's limited production capacity would make it impractical to perform a second life extension effort on the B61 bomb at that time.

[43] GAO-09-828.

Regardless of the approach that NNSA undertakes for the life extension program, DOD and NNSA officials told us that there are options that could be taken to mitigate gaps in the U.S. commitments to NATO that are caused by delays to the program. These options include changing the refurbished weapon's required delivery schedules; allowing the bomb's power supply to expire, which reduces the reliability of the weapon; and changing the quantity of U.S. nuclear weapons committed to NATO. However, as shown in table 3, each of these options has considerable drawbacks.

**Table 3: Options for Mitigating a Gap in U.S. Commitments to NATO**

| Option | Description | Principal drawbacks |
|---|---|---|
| Change required delivery schedules | Currently, DOD requires the delivery of strategic versions of the refurbished bombs about 6 months earlier than those committed to support NATO. This option reverses these schedules, so that the initially refurbished bombs are used to meet U.S. NATO commitments if production schedules are delayed. Alternatively, NNSA produces and replaces limited-life components for the strategic versions of the bomb. | • U.S. Strategic Command would be required to offset lost capabilities with other nuclear weapons.<br>• Added cost to NNSA for producing and replacing limited life components. |
| Existing weapons allowed to operate with reduced reliability | Power supplies allowed to reach the end of their life. | • According to officials from the Office of the Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy, this option would require "unacceptable" changes to U.S. and NATO policy. |
| Change U.S. nuclear weapons posture | The U.S. President reduces the number of weapons authorized to be committed to support NATO. | • Would require United States to alter the capability to deploy weapons to NATO during a crisis.<br>• Could reduce opportunities for NATO allies to actively take part in the nuclear mission.<br>• Could be unsettling to NATO allies. |

Source: GAO analysis of DOD information.

Although DOD officials told us that such options could be available to DOD as the B61 life extension program moves forward, they added that DOD and NNSA have not prepared a long-term risk management plan to preserve operational capability. DOD and NNSA have not developed such a plan because there is no such requirement in the *Procedural Guideline for the Phase 6.X Process*, the principal document that establishes the joint DOD-DOE process for nuclear weapons refurbishments. Such a plan would describe the measures that NNSA and DOD could take at different points in time to preserve U.S. commitments to NATO, should the B61 life extension program be delayed. A risk management plan also would identify the resources required to manage and mitigate risk, according to the risk management principles identified in our prior work. Moreover,

according to these principles, DOD and NNSA would continuously monitor and update the plan as circumstances changed. Lacking a long-term risk management plan, DOD may be unprepared to weigh the costs and benefits of potential risk management actions.

DOD and NNSA officials agreed that the B61 Project Officers Group should be responsible for preparing a long-term plan to address potential operational risks, but they added that the group has not done so because it is focused instead on developing the plans and approaches for refurbishing the weapon within required time frames. According to the NNSA program manager for the B61 bomb, because the B61 Project Officers Group is responsible for overseeing activities to sustain the B61 bomb as an operational weapon, the group should develop a long-term plan for sustaining the weapon's capability as the life extension program moves forward. DOD officials agreed that a long-term risk management plan would help DOD identify how to move forward and prepare for potential schedule slippages in the B61 life extension program, and begin thinking about options before they were required. U.S. European Command officials stated that developing such a plan in advance of the life extension program's execution could help DOD and NNSA identify steps to be taken—and when to take them—to preserve the U.S. nuclear weapons commitments to NATO.

According to the *Risk Management Guide for DOD Acquisition*,[44] the alternative to risk management is crisis management, which usually involves increased resources and a restricted set of available options. An operational risk management plan would help the United States to be better prepared to take the steps needed to maintain its nuclear weapons commitments to NATO with no gaps in operational capability during the B61 life extension program. Moreover, like the B61 life extension program, future life extension programs are also expected to increasingly be scheduled against rapidly approaching service-life deadlines, leaving DOD with fewer options to draw upon in order to cover contingencies. Officials from the Office of the Secretary of Defense and NNSA agreed that the relevant project officers group responsible for preparing the Phase 6.2 study should also be responsible for developing plans during that study to manage potential operational risks in order to avoid crisis management. An Air Force official told us that, unless DOD and NNSA prepare plans to

[44]Department of Defense, Defense Acquisition University, *Risk Management Guide for DOD Acquisition*, Sixth Edition, Version 1.0 (Fort Belvoir, Va.: Aug. 2006).

mitigate operational risks as they plan and execute future life extension programs, the programs could end up adversely affecting other nuclear weapons maintenance and sustainment actions as resources are reprioritized to meet operational requirements on an emergency basis. Unless the *Procedural Guideline for the Phase 6.X Process* is updated to require the preparation of an operational risk mitigation plan, operational capability gaps could arise during future life extension programs if they experience schedule delays.

## Conclusions

Given that future nuclear weapons life extension programs are expected to increasingly be scheduled against rapidly approaching service-life deadlines, DOD and NNSA will likely face increased risk to their ability to complete the programs within available time frames and without operational ramifications. We have identified two areas where DOD and NNSA can take steps to reduce or manage such risk. First, DOD and NNSA may incur undue risk unless the time available to complete a life extension program is considered when setting the scope of activities to be considered during the program. The joint DOD-DOE guidance governing the performance of life extension programs does not require the Nuclear Weapons Council to factor in time available to complete life extension programs. For example, the Nuclear Weapons Council requested an ambitious scope for the study that will be used as the basis for the B61 life extension program, in spite of a compressed time schedule and potentially significant risk to U.S. commitments to its NATO allies. The reasons for this ambitious scope were many and included desires to improve nuclear weapons safety, minimize maintenance requirements, and exercise NNSA's nuclear weapons design and production capabilities. These goals should have been weighed against the reality that the B61 life extension program will be conducted within very tight time frames to ensure completion before the existing weapons begin to become nonoperational. However, the Nuclear Weapons Council may not have fully accounted for the time available to plan for and complete the life extension program when it laid out the broad scope. The B61 Project Officers Group has until September 2011 to complete the study and assess the risk of different design options. Although we are not making a recommendation that the Nuclear Weapons Council revise the scope of this effort to better reflect the available time, it is important to note that these actions have implications for future life extension programs, which are also expected to face highly constrained time lines. Without a requirement to factor in the time available to complete future life extension programs, the Nuclear Weapons Council may increase the risk that the programs will not be properly scoped.

Second, similar to the B61 life extension program, future nuclear weapons life extension programs, including those for weapons deployed on ICBMs and submarines, will have their own complexities and challenges to overcome. The operational consequences of failing to complete these programs on time could be significant, given the purposes for which these weapons are deployed. However, the joint DOD-DOE guidance governing the performance of life extension programs does not require DOD and NNSA to prepare a plan for managing operational risks that may occur if a life extension program is delayed. As a result, DOD and NNSA have not prepared a long-term risk management plan for ensuring operationally capable B61 bombs to support NATO commitments throughout the life extension program. Such a plan would help ensure that the weapons remain operational throughout the life extension program, thus helping preserve the commitment to NATO. Looking ahead, unless DOD and DOE take steps to update their guidance to reflect the need for such a plan, DOD and NNSA may be required to take difficult policy and programmatic actions to preserve operational requirements during the execution of the B61 life extension and future life extension programs.

## Recommendations for Executive Action

We are recommending that the Secretaries of Defense and Energy direct the Nuclear Weapons Council to take the following three actions:

To reduce the risk that future Phase 6.2 studies for nuclear weapons life extension programs are not properly scoped given available time for completing a life extension, revise the *Procedural Guideline for the Phase 6.X Process* to require that the council factor in the time available for completing a life extension program when establishing the scope of a Phase 6.2 feasibility study of military performance requirements and design options.

To mitigate the risk that U.S. operational commitments will be affected by life extension program schedule delays:

- Direct the appropriate DOD components, in coordination with NNSA, to prepare an operational risk management plan identifying the measures that would be required to ensure that the United States is able to maintain its commitments to NATO with no gaps in operational capability while the B61 life extension program is being carried out.
- Revise the *Procedural Guideline for the Phase 6.X Process* to require the council to direct the preparation of operational risk management plans during the planning and execution of future life extension programs.

## Agency Comments and Our Evaluation

We provided DOD and NNSA with copies of our draft classified report for their review and comment. DOD concurred with all three of the recommendations, and identified actions that it would take toward implementing each one. NNSA also generally concurred with our report and recommendations, but did not comment on specific findings or recommendations in the draft report. DOD's comments appear in their entirety in appendix II, and NNSA's in appendix III. Both agencies also provided technical comments, which we have incorporated into the draft as appropriate.

DOD concurred with our recommendation that the Secretaries of Defense and Energy direct the Nuclear Weapons Council to revise the *Procedural Guideline for the Phase 6.X Process* to require that the council factor in time available for completing a life extension program when establishing the scope of a Phase 6.2 feasibility study. In its comments, DOD stated that the Under Secretary of Defense for Acquisition, Technology, and Logistics will recommend that the Nuclear Weapons Council revise these guidelines to take into consideration the available time. However, DOD also commented that while working within established time constraints is important, the time available to complete a life extension program is one of many competing factors that the Nuclear Weapons Council must consider when scoping a Phase 6.2 study. DOD also commented that the Nuclear Weapons Council should avoid placing unnecessary restrictions on exploring the design options identified by technical experts early in the study. While we agree that the time available to carry out a life extension program is one of many competing factors to consider when scoping a Phase 6.2 study, and that prudent exploration of design options should not be restricted, scoping the study to meet the available time has become critical to the success of life extension programs. As we stated in our draft report, the broad scope of the B61 Phase 6.2 study complicated the study effort, given the limited time for NNSA to produce refurbished weapons before the currently deployed B61 bombs begin reaching the end of their service life. While it is too soon to tell what effect the broad scope will have on the B61 life extension program overall, future life extension programs will face similar time constraints, as other weapons in the stockpile approach the end of their service life. We believe that if the procedural guideline is revised and the Nuclear Weapons Council factors time constraints into setting the scope of Phase 6.2 studies for future life extension programs, the likelihood of success will be improved.

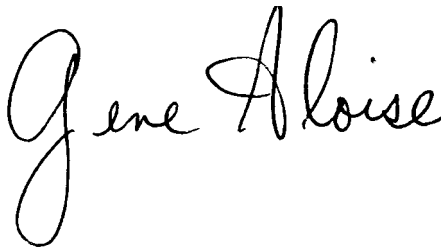
DOD also concurred with our two recommendations that are intended to mitigate the risk that U.S. operational commitments will be affected by life extension program schedule delays. First, DOD concurred with our

recommendation that the Secretaries of Defense and Energy direct the appropriate DOD components, in cooperation with NNSA, to prepare an operational risk management plan to ensure no gaps in operational capability while the B61 life extension program is being carried out. In response to this recommendation, DOD stated that the Under Secretary of Defense for Acquisition, Technology, and Logistics will recommend that the Nuclear Weapons Council formally task the "B61 Life Extension Group"[45] to provide an operational risk assessment plan and mitigation scenarios ensuring there is no gap in supporting the NATO nuclear deterrent mission. DOD also concurred with our recommendation that the Secretaries of Defense and Energy direct the Nuclear Weapons Council to revise the *Procedural Guideline for the Phase 6.X Process* to direct the preparation of operational risk management plans during future life extension programs. In its comments DOD stated that the Under Secretary for Defense for Acquisition, Technology, and Logistics will request that the council revise the guideline to require operational risk management plans as part of the Phase 6.X process. We agree that DOD's proposed actions to provide an operational risk management plan for the B61 life extension program as well revise the procedural guideline to require such plans, will meet the intent of our recommendations once they are implemented.

We are sending copies of this report to the appropriate congressional committees; the Secretary of Defense; the Secretary of the U.S. Air Force; the Chairman, Joint Chiefs of Staff; the Commander, U.S. Strategic Command; the Commander, U.S. European Command, and NATO Supreme Allied Commander Europe; the Secretary of Energy; and the Administrator of the National Nuclear Security Administration. In addition, the report will be available at no charge on our Web site at http://www.gao.gov.

[45]The B61 Life Extension Group is a subgroup of the B61 Project Officers Group, according to the Air Force lead project officer of the B61 bomb.

If you or your staffs have any questions about this report, please contact Gene Aloise at (202) 512-3841 aloisee@gao.gov or John Pendleton at (202) 512-3489 or pendletonj@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report are listed in appendix IV.



Gene Aloise
Director, Natural Resources and Environment

John Pendleton
Director, Defense Capabilities and Management

# Appendix I: Scope and Methodology

For this review we addressed the extent to which the Department of Defense (DOD) and the National Nuclear Security Agency (NNSA) have (1) considered the time available to begin producing refurbished bombs when determining the scope of military performance requirements and design options for the B61 life extension program; and (2) taken actions to avoid operational gaps in U.S. nuclear weapons commitments to NATO during the B61 life extension program. For our review of these two objectives, we obtained and reviewed key DOD and Department of Energy (DOE) documentation for implementing the Phase 6.X process in order to understand the roles of the DOD, DOE, Nuclear Weapons Council, B61 Project Officers Group, and other organizations throughout the B61 life extension process. This documentation included: the Joint DOD-DOE *Procedural Guideline for Implementing the Phase 6.X Process*, dated April 2000; DOE's *Procedural Guidelines for the Phase 6.X Process*, dated October 2000, and DOD Instruction 5030.55, *DOD Procedures for Joint DOD-DOE Nuclear Weapons Life Cycle Activities*, dated January 2001. We obtained and reviewed briefings from the Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, Office of the Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy, U.S. Strategic Command, U.S. European Command, and the Air Force Nuclear Weapons Center to understand their roles and responsibilities in the management and oversight of the U.S. stockpile, including the Phase 6.X process. We also reviewed briefings from the NNSA Office of the Deputy Administrator for Defense Programs to understand NNSA's role in the day-to-day activities of managing the U.S. stockpile and executing the B61 life extension program. To provide us with an understanding of the role that the B61 bomb plays in U.S. national security, we obtained and reviewed briefings from U.S. Strategic Command, U.S. European Command, and the North Atlantic Treaty Organization (NATO). We also met with the Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy to discuss how DOD determines requirements for nuclear weapons capabilities and force structure, and reviewed briefings outlining the roles played by the President, Secretary of Defense, and Chairman of the Joint Chiefs of Staff, to prepare operational direction and guidance for the employment of nuclear weapons. To put the B61 life extension program in a broader programmatic context, we reviewed the administration's *Nuclear Posture Review Report*, dated April 2010; the May 2010 *Report in Response to National Defense Authorization Act Fiscal Year 2010 Section 1251 New START Treaty Framework and Nuclear Force Structure Plans*; and the NNSA's *Fiscal Year 2011*

*Stockpile Stewardship and Management Plan Summary*, also published in May 2010.[1] To provide context on the challenges of implementing life extension programs on nuclear weapons, we reviewed prior GAO reports, and reviewed the Nuclear Weapons Council's annual *Report on Stockpile Assessments*, which include reports by the directors of Sandia, Los Alamos, and Livermore National Laboratories on the status of the U.S. stockpile. We also obtained and reviewed reports and briefings prepared by the U.S. Strategic Command Strategic Advisory Group, and reports prepared by the JASON group.[2]

To determine the extent to which DOD and NNSA considered the time available to begin producing refurbished B61 bombs when determining the scope of the on-going study of military performance requirements and design options, we examined both the scope of the study and the time frames for performing the B61 life extension program by reviewing documents and interviewing officials from both DOD and NNSA. In particular, we analyzed the June 2008 memorandum to the Members of the Nuclear Weapons Council's Standing and Safety Committee, requesting that the B61 Project Officers Group conduct a Phase 6.2/6.2A study, evaluate military performance requirements, and recommend design options for the B61 life extension program. We reviewed documentation for the B61 life extension program from the Office of the Secretary of Defense, U.S. Strategic Command, U.S. European Command, U.S. Air Forces in Europe, and NATO. To track the B61 Project Officers Group's progress in evaluating military performance requirements, we compared successive revisions to the refurbished B61 bomb's draft military characteristics, and discussed how they have changed with key NNSA and Air Force officials, including the official responsible for managing the changes to the B61 bomb's requirements. We reviewed relevant documents and discussed the challenges of reconciling requirements with officials from the Air Force, U.S. European Command, NATO, and the NNSA. We also reviewed the Air Force's requirements documentation prepared to support the acquisition of a tailkit for the refurbished B61 bomb, and determined the linkage of this design option to key DOD requirements by obtaining and reviewing documentation from U.S. Strategic Command,

[1]Department of Energy, National Nuclear Security Administration, *Fiscal Year 2011 Stockpile Stewardship and Management Plan Summary* (Washington, D.C.: May 2010).

[2]JASON is an independent group of accomplished scientists that advises the U.S. government on matters of science and technology. The name "JASON" is not an acronym. Its sponsors include DOD, DOE, and the U.S. Intelligence Community.

U.S. European Command, NNSA, and the B61 Project Officers Group. We identified and reviewed key NNSA and Air Force briefings that evaluated design options for the life extension program, and tracked the B61 Project Officers Group's progress in narrowing the scope of design options by obtaining and analyzing status briefings that the B61 Project Officers Group prepared throughout the 6.2/6.2A study for the Nuclear Weapons Council's Standing and Safety Committee. We compared the scope of the ongoing B61 6.2/6.2A study with the scope of the life extension programs for the W87 intercontinental ballistic missile warhead, the W76 submarine-launched ballistic missile warhead, the W80 cruise missile warhead, and the refurbishment of the secondary components of the strategic versions of the B61 bomb. We identified the scope of these prior life extension programs and refurbishments by obtaining the Nuclear Weapons Council's direction to establish the life extension programs and other key documentation. We identified criteria for assessing the scope of the B61 life extension program study, given available time, by reviewing our prior work on best practices for designing evaluations and conducting studies.[3] To understand the challenges of evaluating requirements and design options for the B61 study, we traveled to the Air Force Nuclear Weapons Center in Albuquerque, New Mexico, to interview the lead project officer of the B61 Project Officers Group, and other key officials involved in the preparing the B61 bomb's requirements. We interviewed NNSA officials involved in the management and oversight of the B61 stockpile, both in NNSA headquarters and at the NNSA Service Center in Albuquerque, New Mexico. These officials included the NNSA program manager for the B61 bomb and other officials from NNSA's Office of the Deputy Administrator for Defense Programs. We met with senior DOD officials, including officials from the Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters; the Office of the Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy; U.S. Strategic Command; U.S. European Command; U.S. Air Forces in Europe; and NATO. We visited U.S. Strategic Command in Omaha, Nebraska, and met with the U.S. Strategic Command Chief of Staff and other senior military officers and civilian officials from the command. We also interviewed other DOD officials throughout our work, including officials from: the Deputy Director for Strategy and Policy (J5), Joint Staff; Defense Threat Reduction Agency; Office of the Assistant Chief of Staff of the Air Force for Strategic Deterrence and Nuclear Integration. We also analyzed briefings from, and met with, the Air Force lead project officers for the

[3]GAO, *Designing Evaluations*, GAO-PEMD 10.1.4 (Washington, D.C.: May 1991).

B83, W78, W80, and W87 Project Officers Groups; the Navy lead project officer for the W76 and W88 Project Officers Group; the U.S. Army Nuclear and Combating Weapons of Mass Destruction Agency, and the NNSA program managers for the W76, W78, W80, B83, W87, and W88 nuclear weapon systems.

To determine the extent to which DOD and NNSA have taken actions to avoid operational gaps in U.S. nuclear weapons commitments to NATO during the B61 life extension program, we identified U.S. nuclear weapons commitments for NATO by reviewing National Security Presidential Directive 35, the presidential guidance that establishes the required number of nuclear weapons to be committed to NATO; and by obtaining and reviewing DOD's requirements for declaring an initial operating capability for both strategic and nonstrategic B61 bombs. Further, we reviewed key NATO documentation, including *The Alliance's Strategic Concept*, the Nuclear Planning Group's *Political Principles for Nuclear Planning and Consultation*, and High Level Group reports, and received briefings from the U.S. European Command and NATO outlining these operational requirements. We determined the commitments made by the United States to preserve this operational capability by reviewing the June 2008 memorandum requesting the start of the B61 life extension program study; the April 2010 *Nuclear Posture Review Report*; and the June 2010 speech by the Secretary of Defense to NATO. We clarified that we fully understood these commitments by interviewing the Deputy Assistant Secretary of Defense for Nuclear and Missile Defense Policy and other DOD officials. To obtain operational perspectives on these commitments, we traveled to Stuttgart, Germany, and Kaiserslautern, Germany, where we met with officials from U.S. European Command and U.S. Air Forces in Europe, respectively, and visited NATO in Brussels, Belgium, to meet with officials from the U.S. Mission to NATO, with an official from NATO's Supreme Headquarters, Allied Powers Europe, the NATO Deputy Assistant Secretary General for Weapons of Mass Destruction Policy, and a member of the NATO International Military Staff. We identified potential challenges to the B61 life extension program by reviewing our prior work on nuclear weapons life extension programs and by interviewing NNSA nuclear weapons program managers, Navy and Air Force lead project officers, officials from the Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters, and other DOD officials. To identify risk management criteria and the key elements of a risk management approach, we used prior GAO work and the Defense Acquisition University's August 2006 *Risk Management Guide for DOD Acquisition*. We obtained information on the B61 Project Officers Group's overall risk management approach by reviewing the December 2008 *B61 Life*

*Extension Project Risk Management Plan* and interviewing the NNSA program manager and Air Force lead project officer for the B61 bomb. We discussed possible risk mitigation steps in light of the potential challenges to the B61 life extension program with officials from the Office of the Deputy Assistant to the Secretary of Defense for Nuclear Matters; Office of the Deputy Assistant to the Secretary of Defense for Nuclear and Missile Defense Policy; U.S. European Command; and both DOD and NNSA members of the B61 Project Officers Group, including the Air Force lead project officer and the NNSA program manager for the B61 bomb.

We conducted this performance audit from October 2009 to December 2010 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

# Appendix II: Comments from the Department of Defense

[redacted]

ASSISTANT TO THE SECRETARY OF DEFENSE
3050 DEFENSE PENTAGON
WASHINGTON, DC 20301-3050

NUCLEAR AND CHEMICAL AND BIOLOGICAL DEFENSE PROGRAMS

NOV 17 2010

Mr. John Pendleton
Director, Defense Capabilities and Management
U.S. Government Accountability Office
441 G Street, N.W.
Washington, D.C. 20548

Dear Mr. Pendleton:

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) draft report [redacted] "NUCLEAR WEAPONS: DoD and NNSA Need To Better Manage Scope of Future Refurbishments and Risks to Maintaining U.S. Commitments to NATO," dated October 4, 2010 (GAO Code 351404). The DoD concurs with all GAO recommendations contained in the draft report. We have provided specific comments to each recommendation in the enclosed Department of Defense Comments to the GAO Recommendations.

Technical corrections suggested to further enhance the report were forwarded under separate cover. If you have any questions, please call me at 703-697-1771. The point of contact for this issue is Mr. David Court, 703-693-4304, david.court@osd.smil.mil or david.court@osd.mil.

Sincerely,

Andrew Weber

Enclosure:
As stated

UNCLASSIFIED when separated from enclosure.

[redacted]

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GAO DRAFT REPORT DATED OCTOBER 4, 2010
[redacted]

NUCLEAR WEAPONS: DOD AND NNSA NEED TO BETTER MANAGE SCOPE OF FUTURE REFURBISHMENTS AND RISKS TO MAINTAINING U.S. COMMITMENTS TO NATO

DEPARTMENT OF DEFENSE COMMENTS TO THE GAO RECOMMENDATIONS

(U) **RECOMMENDATION 1:** The GAO recommends that the Secretaries of Defense and Energy direct the Nuclear Weapons Council to revise the *Procedural Guideline for the Phase 6.X Process* to require that the Council factor in the time available for completing a life extension program when establishing the scope of a Phase 6.2 feasibility study of military performance requirements and design options. (See page 40 of the Draft report)

(U) **DoD RESPONSE:** The Department concurs with the recommendation but recognizes that time available for completing a life extension program is one of many competing factors that the Nuclear Weapons Council (NWC) must consider when establishing the scope of a Phase 6.2 feasibility study. The Department considers it important to work within established time constraints, but must also avoid unnecessary restrictions on design options that are identified by the technical experts during the initial study phases. The USD(AT&L) will recommend that the NWC revise the *Procedural Guidelines for the Phase 6.X Process* to take into consideration the amount of time available for completion of the life extension program when assigning the scope of the 6.2 study. The Department recognizes that the Phase 6.X Process must maintain the ability to document deviations with acknowledgement that changes within contingency are allowed.

(U) **RECOMMENDATION 2:** The GAO recommends that the Secretaries of Defense and Energy direct the Nuclear Weapons Council to direct the appropriate DoD components, in coordination with NNSA, to prepare an operational risk management plan identifying the measures that would be required to ensure that the United States is able to maintain its commitments to NATO [redacted] with no gaps in operational capability while the B61 life extension program is being carried out. (See page 40 of the Draft report)

(U) **DoD RESPONSE:** The Department concurs with the recommendation and the USD(AT&L) will recommend the NWC formally task the B61 Life Extension Group to provide an operational risk assessment plan and mitigation scenarios ensuring there is no gap in supporting [redacted]

[redacted]//FORMERLY RESTRICTED DATA

~~SECRET//FORMERLY RESTRICTED DATA~~

(U) **RECOMMENDATION 3:** The GAO recommends that the Secretaries of Defense and Energy direct the Nuclear Weapons Council to revise the *Procedural Guideline for the Phase 6.X Process* to require the Council to direct the preparation of operational risk management plans during the planning and execution of future life extension programs. (See page 40 of the Draft report)

(U) **DoD RESPONSE:** The Department concurs with the recommendation and the USD(AT&L) will request the NWC revise the *Procedural Guideline for the Phase 6.X Process* to require operational risk management plans as part of the Phase 6.X process for the planning and execution of future life extension programs.

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# Appendix III: Comments from the National Nuclear Security Administration

**Department of Energy**
**National Nuclear Security Administration**
Washington, DC 20585

November 4, 2010

Mr. Gene Aloise
Director
Natural Resources and Environment
Government Accountability Office
Washington, DC 20548

Dear Mr. Aloise:

The National Nuclear Security Administration (NNSA) appreciates the opportunity to review the Government Accountability Office's (GAO) draft repo[redacted]*NUCLEAR WEAPONS: DOD and NNSA Need to Better Manage Scope of Future Refurbishments and Risks to Maintaining U.S. Commitments to NATO.* We understand that this work was done at the request of the Subcommittee on Strategic Forces, Committee on Armed Services, House of Representatives, to review the Department of Defense's military requirements for nuclear weapons and force structure.

NNSA generally agrees with the report and the recommendations. NNSA recognizes that a life extension Phase 6.2 Study is the single opportunity to determine a weapon's optimal balance of performance, surety, and life-cycle cost over its next 30 to 40 years of stockpile service. Hence, we believe it to be the best course of action to consider all viable enhancements consistent with schedule, funding and acceptable risk as part of the Phase 6.1/6.2 Study.

Under separate cover we will send technical comments to help clarify and improve the report in areas that may be confusing or misleading.

If you have any questions related to this response, please contact JoAnne Parker, Director, Office of Internal Controls, at 202-586-1913.

Sincerely,

Gerald L. Talbot, Jr.
Associate Administrator
for Management and Administration

cc: Deputy Administrator for Defense Programs

Printed with soy ink on recycled paper

# Appendix IV: GAO Contacts and Staff Acknowledgments

## GAO Contacts

Gene Aloise (202) 512-3841 or aloisee@gao.gov

John H. Pendleton (202) 512-3489 or pendletonj@gao.gov

## Staff Acknowledgments

In addition to the contacts named above, Jonathan M. Gill, Assistant Director; Penney Harwell Caramia, Assistant Director; Colin L. Chambers; Grace A. Coleman; David G. Hubbell; Katherine S. Lenane; Gregory A. Marchand; Kevin L. O'Neill, Analyst in Charge; Timothy M. Persons; Steven R. Putansu; Robert Robinson; Jeff R. Rueckhaus; and Rebecca Shea also made key contributions to this report.

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