United States Government Accountability Office

Report to the Committee on Armed Services, U.S. Senate

February 2016

NUCLEAR WEAPONS

NNSA Has a New Approach to Managing the B61-12 Life Extension, but a Constrained Schedule and Other Risks Remain

GAO-16-218

GAO Highlights

Highlights of GAO-16-218, a report to the Committee on Armed Services, U.S. Senate

February 2016

NUCLEAR WEAPONS

NNSA Has a New Approach to Managing the B61-12 Life Extension, but a Constrained Schedule and Other Risks Remain

Why GAO Did This Study

Weapons in the U.S. nuclear stockpile are aging. NNSA and DOD undertake LEPs to refurbish or replace nuclear weapons' aging components. In 2010, they began an LEP to consolidate four versions of a legacy nuclear weapon, the B61 bomb, into a bomb called the B61-12 (see fig.). NNSA and DOD have stated they must complete this LEP by 2024 to uphold U.S. commitments to the North Atlantic Treaty Organization. As of September 2015, NNSA and DOD estimated that the B61-12 LEP would cost about $8.9 billion.

Senate Report 113-44 included a provision for GAO to periodically assess the status of the B61-12 LEP. This report assesses (1) NNSA's management approach for the B61-12 LEP and (2) the extent to which NNSA and the Air Force are managing risks in the LEP. GAO reviewed project plans, schedules, management plans, and other documents and program data, and visited the two NNSA national laboratories—Sandia and Los Alamos—that serve as the design agencies for the LEP.

What GAO Recommends

GAO is making no new recommendations but discusses the status of prior GAO recommendations in this report. In commenting on a draft of this report, DOE generally agreed with GAO's findings and provided technical comments that were incorporated, as appropriate. DOD provided technical comments that were also incorporated, as appropriate.

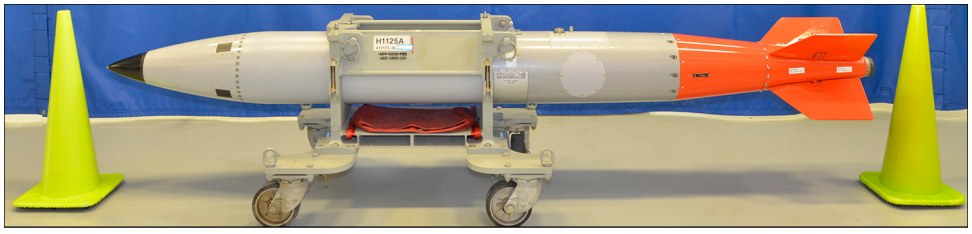
View GAO-16-218. For more information, contact David C. Trimble at (202) 512-3841 or trimbled@gao.gov.

What GAO Found

The B61-12 life extension program's (LEP) managers have developed a management approach that officials from the Department of Energy's (DOE) National Nuclear Security Administration (NNSA) and the Department of Defense (DOD) regard as improved over the management approach used for past LEPs, which experienced schedule delays and cost overruns. Among other things, the B61-12 LEP is the first LEP to use earned value management, a tool that measures the planned versus actual value of work accomplished in a given period, which may help NNSA ensure that work progresses on budget and on schedule. It is also the first LEP to integrate the schedules and cost estimates for activities at all participating NNSA sites. NNSA used this new approach to inform its first Program Execution Guide for defense programs, issued in August 2014, which applies to all NNSA defense programs. NNSA's new management approach notwithstanding, the B61-12 LEP faces ongoing management challenges in some areas, including staff shortfalls and an earned value management system that has yet to be tested. The new management approach may help the LEP address these potential challenges, but it is too soon to determine whether this will be the case.

To manage risks in the B61-12 LEP, NNSA and the Air Force use a risk management database and integrated schedules to categorize risks and incorporate risk management steps in the schedules. According to NNSA and Air Force officials, some risks have already been managed in this manner. For example, NNSA estimates that making a needed material procurement in advance prevented a potential delay of more than a year and a potential cost increase of more than $2 million. Remaining risks include the risk that components may fail in certain flight environments and risks related to testing of certain nonnuclear components. NNSA is also working to ensure future compatibility with the F-35 aircraft. NNSA and Air Force officials said they will not know for several years whether steps planned to manage these risks are adequate. A constrained development and production schedule—which DOE's and DOD's Nuclear Weapons Council characterized as having "little, if any, margin left"—complicates efforts to manage risks. Factors constraining the schedule include the aging of components in current versions of the B61, delays in starting the B61-12 LEP because of a lengthy design study, the effects of sequestration, and the need to complete the B61-12 LEP so that NNSA can begin other planned LEPs. GAO will continue to monitor these issues as it assesses the LEP in later stages.

The B61-12



Source: © 2015, Sandia National Laboratories. | GAO-16-218

Contents

Abbreviations

AIMS	Air Force Integrated Master Schedule
BIMS	Boeing Integrated Master Schedule
B61 bomb	B61 legacy bomb
CD	critical decision
Cost Guide	*GAO Cost Estimating and Assessment Guide*
DOD	Department of Defense
DOE	Department of Energy
DOE's project management order	DOE Order 413.3B
FTE	full-time equivalent
JIMS	Joint Integrated Master Schedule
LEP	life extension program
NATO	North Atlantic Treaty Organization
NIMS	NNSA Integrated Master Schedule
NNSA	National Nuclear Security Administration
Program Execution Guide	*Defense Programs Program Execution Guide*
PRT	product realization team
SSMP	*Stockpile Stewardship and Management Plan*
UPF	Uranium Production Facility

U.S. GOVERNMENT ACCOUNTABILITY OFFICE
441 G St. N.W.
Washington, DC 20548

February 4, 2016

The Honorable John McCain
Chairman
The Honorable Jack Reed
Ranking Member
Committee on Armed Services
United States Senate

Many weapons in the U.S. nuclear stockpile have aged far beyond their designed operational lives and, according to the Department of Defense (DOD), require modernization to ensure that the nuclear arsenal is safe, secure, and effective for as long as such weapons exist.[1] Some of the oldest of the weapons in the active stockpile are versions of the B61 bomb, an aircraft-delivered weapon that is a key component of the United States' commitments to the North Atlantic Treaty Organization's (NATO) nuclear deterrent.[2] To maintain the readiness of the B61 and other weapons in the stockpile, the Department of Energy's (DOE) National Nuclear Security Administration (NNSA)[3] and DOD undertake life extension programs (LEP) that entail refurbishing or replacing weapons' components to extend the lives of weapons by 20 years or more. LEPs may also enhance safety and security characteristics of weapons, as well as consolidate the stockpile into fewer weapon types to minimize maintenance and testing costs while preserving needed military capabilities.

[1] *See* DOD, *Nuclear Posture Review Report* (Washington, D.C.: Apr. 6, 2010).

[2] The B61s committed to NATO 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.

[3] Established in 1999, NNSA is a semiautonomous agency within the U.S. Department of Energy responsible for the nation's nuclear weapons, nonproliferation, and naval reactor programs. NNSA maintains and enhances the safety, security, reliability and performance of the U.S. nuclear weapons stockpile without nuclear testing; works to reduce global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the United States and abroad.

Under the B61 LEP, NNSA and the Air Force—the armed service responsible for air-delivered weapons such as the B61—plan to consolidate four of the five versions of the B61 bomb (B61 legacy bombs[4]), each of which was designed to fulfill specific military requirements, into a single weapon known as the B61-12, which will be equipped with a new tail kit guidance assembly that will enable it to meet all military requirements. The consolidation of B61 legacy bombs into the single B61-12 weapon is expected to allow NNSA and DOD to reduce the number of nuclear gravity bombs[5] in the stockpile by about one-half. In addition, DOD and NNSA expect the B61-12 to provide mission capabilities that will allow the retirement of a megaton-class weapon, the B83-1 bomb, that would be expected to produce significantly more collateral damage than the lower-yield B61-12. Altogether, the reduction in the number of bombs and retirement of the B83-1 bomb will reduce the amount of special nuclear material in the U.S. stockpile of gravity bombs by more than one-half.[6] Because critical components in B61 legacy bombs are approaching the end of their operational lives, NNSA and DOD have underscored the importance of beginning production of the B61-12 in 2020 and completing the LEP by 2024 to uphold the United States' commitments to NATO's nuclear deterrent. With thousands of individual components, the B61-12 LEP is the most complicated and expensive LEP undertaken since DOE initiated stockpile life extension activities in January 1996.

We have examined other LEPs in past reports and found that NNSA and DOD have had difficulty effectively managing these programs. In March 2009, for example, we found that, in LEPs for the W76 warhead and legacy B61 bombs, NNSA and DOD established unrealistic schedules, did not establish consistent cost baselines, and did not effectively

[4]Legacy B61 bombs comprise three tactical bombs, known as the B61-3, the B61-4, and the B61-10, and two strategic bombs, the B61-7 and the B61-11. The B61-12 LEP consolidates capabilities of the three tactical variants and the B61-7.

[5]All nuclear weapons in the U.S. stockpile are designated either as a warhead or as a bomb. Weapons that have different engineering requirements because they must interface with a launch or delivery system are called warheads. Weapons that do not have these interface requirements, such as gravity bombs and atomic demolition munitions (now retired and dismantled), are called bombs.

[6]Special nuclear material includes plutonium and uranium enriched in the isotopes of uranium-235 and uranium-233.

manage technical risks.[7] These problems resulted in delays, additional expenditures, difficulties tracking the cost of the W76 program, and a B61 refurbishment that did not meet all of NNSA's and DOD's technical objectives. We recommended that NNSA develop and use consistent budget assumptions and criteria for the baseline to track costs over time, among other actions. NNSA agreed with our recommendation and has taken steps toward improvement in this area, which we continue to monitor. In addition, in a May 2011 report on the B61 LEP, we found that NNSA and DOD had not yet prepared a long-term risk management plan to help avoid operational gaps and ensure that the United States would be able to maintain the capability to support its NATO commitments if the LEP were delayed or canceled.[8] We recommended in that report that the appropriate DOD components, in coordination with NNSA, prepare an operational risk management plan for the LEP, identifying the measures required to ensure that the United States is able to maintain its commitments to NATO with no gaps in operational capability, among other recommendations. DOD and NNSA agreed with our recommendations and, in September 2011, the Air Force, in coordination with NNSA, issued an initial program delay risk mitigation plan. The plan presented risk mitigation options in the event that the LEP was delayed. The Air Force is currently updating the plan.

The cost and schedule of the B61-12 LEP have been subject to significant changes since the LEP's inception. Since our May 2011 report,[9] NNSA's and the Air Force's total cost estimate for the LEP has increased from an initial estimate of about $4 billion to about $8.9 billion,

[7]The W76 warhead is used on submarine launched ballistic missiles. W76 warheads comprise a large share of the U.S. nuclear stockpile. Our March 2009 report reviewed refurbishments of the two strategic variants of the legacy B61 weapon, the B61-7 and the B61-11. See 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).

[8]GAO, *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 (Washington, D.C.: May 2, 2011). At the time of the issuance of our May 2011 report, NNSA and DOD were still studying design options for the B61 LEP and had not yet selected the B61-12 design.

[9]GAO-11-387.

as of September 2015,[10] and the first production date has moved from 2017 to 2020.[11] Much of the work under this LEP remains to be executed, with the largest share of program spending yet to come; as of September 2015, about $1.6 billion has been spent on the LEP.[12]

In this context, Senate Report 113-44, accompanying S. 1197, National Defense Authorization Act for Fiscal Year 2014, includes a provision for us to examine key elements of the B61-12 LEP and periodically review it as it passes through the phases of the seven-step process—known as the Phase 6.X process—under which NNSA and DOD jointly manage LEPs. The B61-12 LEP is currently in Phase 6.3 of the process. In this phase—the development engineering phase—NNSA and the Air Force conduct experiments, tests, and analyses to develop and validate the selected design option. This report assesses (1) NNSA's management approach for the B61-12 LEP and (2) the extent to which NNSA and the Air Force are managing risks in the LEP.

To assess NNSA's management approach for the LEP, we reviewed documents that establish cost and schedule goals and track the program's progress toward those goals. These documents included project plans, schedules, management plans, and selected acquisition reports. In addition, we visited NNSA's Sandia National Laboratories and Los Alamos National Laboratory, the two laboratories that serve as design agencies for the LEP, to view systems that track project activities, cost and schedule information, and the execution of risk management

[10]The September 2015 estimate is based on estimated expenditures of about $7.3 billion for NNSA's portion of the work and about $1.6 billion for the Air Force's portion of the work. In addition, according to the NNSA program manager, the B61-12 LEP is leveraging funds—referred to within DOE as "other program monies"—that are used for efforts that serve multiple weapons programs (such as a radar subassembly that will be used in the W80-4 warhead as well as the B61-12). The program manager estimates that funds leveraged in this way to supplement dedicated B61-12 expenditures will total about $800 million.

[11]In our May 2011 report, we found that, at that time, according to the NNSA program manager for the LEP, the preliminary cost estimate for the life extension program was about $4 billion. The program manager and Air Force officials told us in October 2015 that the $4 billion figure and 2017 first production date were rough order of magnitude estimates based on a smaller-scale effort, then under consideration as a design option, rather than the LEP currently being undertaken. *See* GAO-11-387.

[12]Specifically, NNSA's expenditures on the B61-12 LEP through September 2015 have totaled about $1.4 billion, and the Air Force's expenditures for the same time period have totaled about $228 million.

steps, as well as to meet program officials responsible for the design and production of the B61-12 and see some of the components under development. To assess the extent to which NNSA and the Air Force are managing risks in the LEP, we reviewed the documents described above, as well as viewed and discussed the LEP's Active Risk Manager database during our visit to Sandia National Laboratories. For both objectives, we examined DOE directives, such as program orders and guides, NNSA policy letters, and DOD instructions, as well as the B61-12 LEP's program-developed guidance documents and the procedural guidance for the Phase 6.X process. In addition, for criteria and context, we used the *GAO Cost Estimating and Assessment Guide* (Cost Guide)[13] and our past reports on LEPs and NNSA cost estimating practices.[14] Throughout our work, we coordinated with a team from DOE's Office of Inspector General, which is in the process of conducting its own review of the LEP and plans to issue a classified report. Our objectives, scope, and methodology are described in more detail in appendix I.

We conducted this work from July 2014 to February 2016 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

This background section describes (1) objectives, milestones, and management considerations in the B61-12 LEP and (2) DOE directives and NNSA policy letters and how they apply to programs such as the B61-12 LEP.

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

[14]GAO-09-385; GAO-11-387; and GAO, *Project and Program Management: DOE Needs to Revise Requirements and Guidance for Cost Estimating and Related Reviews*, GAO-15-29 (Washington, D.C.: Nov. 25, 2014).

B61-12 LEP Objectives, Milestones, and Management Considerations

The B61-12 consists of two major assemblies: the bomb assembly[15] and the tail kit guidance assembly. NNSA manages the development and production of the bomb assembly and the Air Force manages the development and production of the tail kit assembly, among other activities, as follows:[16]

- **NNSA responsibilities and the bomb assembly.** According to NNSA officials and documents, the bomb assembly will include reused, refurbished, and new nuclear and nonnuclear components. The design approach for the LEP maximizes reuse of existing nuclear and nonnuclear components and is intended to improve the safety and security of the weapon using proven technologies. NNSA manages the development and production of the bomb assembly under the direction of a federal program office and federal program manager located at Kirtland Air Force Base in Albuquerque, New Mexico, which is also the site of NNSA's Sandia National Laboratories. NNSA sites and laboratories involved in the LEP include Sandia National Laboratories, the design agency for nonnuclear components, a production agency for some components, and system-level integrator of the overall weapon design; Los Alamos National Laboratory, the design and production agency for the nuclear explosive package; the Kansas City National Security Campus, the Y-12 National Security Complex, and the Savannah River Site, the production agencies for various new or refurbished weapon components; and the Pantex Plant, where some bomb components are produced and final assembly of the bombs takes place. In addition, Lawrence Livermore National Laboratory provides independent review of Los Alamos National Laboratory's work on nuclear components. As of September 2015, NNSA's expected costs for its share of the LEP work were approximately $7.3 billion.[17]

[15]The term "bomb assembly" refers specifically to three subassemblies for which NNSA is responsible: the nose-bomb, center-bomb, and preflight-bomb subassemblies.

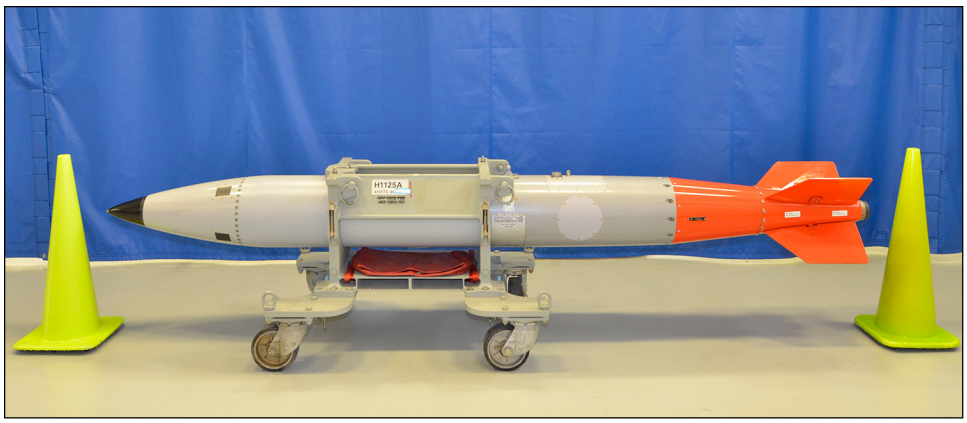
[16]NNSA's management responsibilities include developing and certifying the NNSA components and subassemblies; performing system requirements documentation, test validation, and qualification; and production, assembly, and quality acceptance of the B61-12. The Air Force's responsibilities include developing and certifying the tail kit assembly, as well as adding tail kit requirements and test validation to system-level documentation.

[17]The $7.3 billion figure refers to funds dedicated to the B61-12 LEP and does not include leveraged "other program monies." As noted above, NNSA plans to spend an estimated $800 million in other program monies on activities that serve the B61-12 LEP and other weapons programs.

- **Air Force responsibilities and the tail kit assembly.** According to Air Force officials and documents, the tail kit assembly will provide the B61-12 with a guided freefall capability that improves the accuracy of weapon delivery.[18] The guided capability will enable the weapon to meet military requirements with a lower nuclear yield, allowing for the use of less special nuclear material. The B61-12 is designed to be compatible with existing dual-capable aircraft—the F-15, F-16, and PA-200—as well as the B-2 strategic bomber and planned future aircraft such as the F-35 fighter.[19] The Air Force's responsibilities include integrating the B61-12 with its delivery aircraft and the operational flight program software. This software is being upgraded in the F-15 and B-2 delivery aircraft so that these aircraft can work with the B61-12's digital interface. The Air Force Nuclear Weapons Center at Kirtland Air Force Base manages technical integration, system qualification, and other LEP-related tasks required to certify and field the weapon as well as tail kit acquisition, as contracted to Boeing. As of September 2015, the Air Force's expected costs for its share of the LEP work were approximately $1.6 billion.

Figure 1 shows the B61-12.

Figure 1: The B61-12



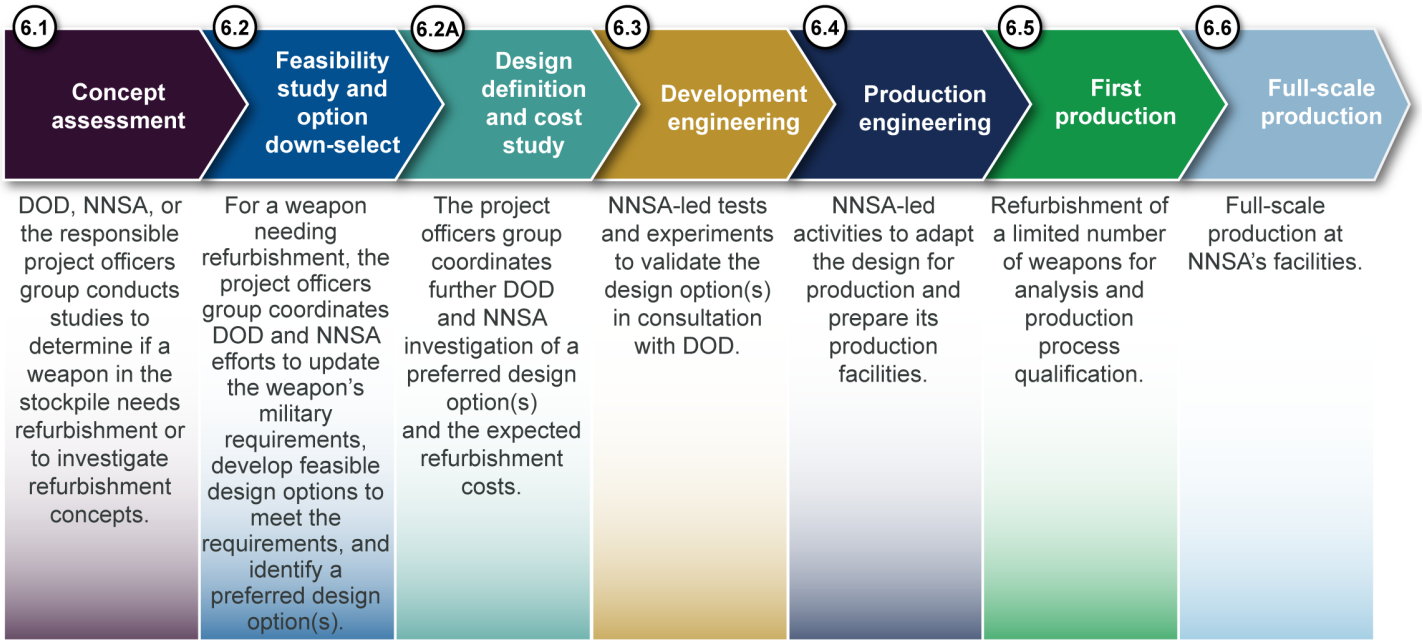
Source: © 2015, Sandia National Laboratories. | GAO-16-218

[18]The weapon will also retain a ballistic delivery capability currently provided by the B61 legacy bombs.

[19]Dual-capable aircraft are fighter aircraft capable of delivering nuclear weapons.

The joint 6.X guidance describes key high-level joint tasks and deliverables for each phase of nuclear refurbishment activities such as an LEP. Specifically, the 6.X guidance lists key milestones, such as tests and cost estimates, that a nuclear weapon refurbishment activity must undertake before proceeding to subsequent steps of the Phase 6.X process (see fig. 2).

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



Abbreviations
DOD Department of Defense
NNSA National Nuclear Security Administration

Source: Nuclear Weapons Council. | GAO-16-218

NNSA and DOD implement the Phase 6.X process under a guidance document, *Procedural Guideline for the Phase 6.X Process*, which was issued in 2000 and is undergoing its first revision.[20] This document describes the roles and functions of DOD, DOE, and NNSA in nuclear weapon refurbishment activities conducted through the Phase 6.X

[20]Nuclear Weapons Council, *Procedural Guideline for the Phase 6.X Process* (Washington, D.C.: Apr. 19, 2000). According to DOD officials, this guidance does not apply to the tail kit acquisition, which is managed as a Major Defense Acquisition Program under DOD Instruction 5000.02, *Operation of the Defense Acquisition System* (Washington, D.C.: Jan. 7, 2015).

process. It also describes the roles and functions of two joint bodies that provide oversight and approval functions to LEPs and other nuclear weapons–related activities: the Nuclear Weapons Council and its Standing and Safety Committee.[21] In addition, the Nuclear Weapons Council charters a Project Officers Group for each weapon system to provide a technical forum for weapon development and management activities. Each Project Officers Group is led by a project officer from either the Navy or Air Force, the two military services that maintain and operate nuclear weapons. Importantly, for more detailed requirements and guidance on program management matters, DOE and DOD each utilize their own agency-specific directives.

In the B61-12 LEP's current phase—6.3, development engineering—NNSA coordinates with the Air Force to conduct experiments, tests, and analyses to develop and validate the selected design option.[22] Key steps that have not yet taken place in Phase 6.3 of the B61-12 LEP include formally developing a program cost baseline—a more mature cost estimate than is currently in use—and finalizing the design definition. Program officials told us they expect to issue the baseline cost report, which will formalize the program's cost baseline, and to approve the baseline design in the third quarter of fiscal year 2016. According to program officials, the LEP is on schedule to enter Phase 6.4 (production engineering) in the fourth quarter of fiscal year 2016.

[21]The Nuclear Weapons Council is the joint DOD and DOE activity that serves as the focal point for interagency activities to maintain the nuclear weapons stockpile. Its membership includes the Under Secretary of Defense for Acquisition, Technology and Logistics (generally the 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 (who also serves as the Administrator of the National Nuclear Security Administration). 10 U.S.C. § 179 (2015); 42 U.S.C. 7132 (2015). For more information on the Nuclear Weapons Council's structure and activities, see, for example, GAO, *Nuclear Weapons Council: Enhancing Interagency Collaboration Could Help with Implementation of Expanded Responsibilities*, GAO-15-446 (Washington, D.C.: May 21, 2015).

[22]Phase 6.3 of the B61-12 LEP began in February 2012. Phase 6.2 (feasibility study and option down-select/design definition and cost study) began in March 2008. Although the Phase 6.X process formally begins with activities under Phase 6.1 (concept assessment), the B61-12 LEP began with a Phase 6.2 study authorization from the Nuclear Weapons Council. Program officials told us that work on recent LEPs for legacy B61 bombs made Phase 6.1 unnecessary in the case of the B61-12 LEP.

The B61-12 LEP is one of several LEPs or refurbishments that NNSA and DOD have plans to undertake or have already started. Other LEPs or refurbishments include the ongoing LEP for the W76 warhead, an alteration to the W88 warhead, and planned LEPs for the cruise missile and interoperable warheads.[23] Some of these activities are or will be taking place concurrently, and several have had their completion dates revised over the years, as shown in table 1. In addition, NNSA plans to move important production operations into new or modified facilities during this time period. Because of overlapping LEPs and new infrastructure, NNSA and DOD officials told us that they recognize the need to continue to improve coordination and management of the nuclear security enterprise.

Table 1: Changes in Production Dates for the National Nuclear Security Administration's (NNSA) Major Modernization Efforts, According to Agency Planning Documents, Fiscal Years 2010-2016

Modernization efforts	Fiscal year 2010 Nuclear Posture Review	Fiscal year 2011 Update to the Joint NNSA and Department of Defense Report	Fiscal year 2012 Stockpile Stewardship and Management Plan	Fiscal year 2013 NNSA congressional budget justification[a]	Fiscal year 2014 Stockpile Stewardship and Management Plan	Fiscal year 2015 Stockpile Stewardship and Management Plan	Fiscal year 2016 Stockpile Stewardship and Management Plan
W76-1 Life Extension Program (LEP) End of Production Date[b]	2017	2018	2018	Not provided[c]	2019	2019	2019
B61-12 LEP First Production Unit Date[d]	2017	2017	2017	Not provided[c]	2019	2020	2020
W88 ALT 370 First Production Unit Date[d]	Not discussed	Not provided	2018[e]	Not provided	2019	2020	2020
Cruise Missile LEP First Production Unit Date[d]	Not discussed	Not discussed	2031	Not provided	2024	2027	2025

[23]The U.S. nuclear weapons stockpile includes air-delivered bombs, ballistic missile warheads, and cruise missile warheads. The Cruise Missile LEP entails a life extension of the W80 warhead. In addition, NNSA has long-range plans for three LEPs for "interoperable" warheads—that is, warheads designed for use on multiple delivery systems.

Modernization efforts	Fiscal year 2010 Nuclear Posture Review	Fiscal year 2011 Update to the Joint NNSA and Department of Defense Report	Fiscal year 2012 Stockpile Stewardship and Management Plan	Fiscal year 2013 NNSA congressional budget justification[a]	Fiscal year 2014 Stockpile Stewardship and Management Plan	Fiscal year 2015 Stockpile Stewardship and Management Plan	Fiscal year 2016 Stockpile Stewardship and Management Plan
Interoperable Warhead-1 (IW-1) LEP First Production Unit Date[d]	Initiate study	Study options	Study options[f]	2023[g]	2025	2030	2030
IW-2 LEP First Production Unit Date[d]	Not discussed	Not discussed	Not discussed	Not discussed	2031	2034	2034
IW-3 LEP First Production Unit Dated	Not discussed	Not discussed	Not discussed	Not discussed	2037	2041	Not specified
Uranium Processing Facility Operational Date[h]	2021	2024	2024	2022	Phase 1: 2025 Begin phases 2 and 3 in 2030.	Phase 1: 2025 Begin phases 2 and 3 in 2030.	Phase 1: 2025
Chemistry and Metallurgy Research Replacement-Nuclear Facility Operational Date	2021	2023	2023	Deferred to 2028 or later.	Deferred. Alternative strategy in development.	Deferred. Alternative strategy in development.	Construct at least two modular structures that will achieve full operating capacity by 2027.

Source: GAO analysis of NNSA planning documents. | GAO-16-218.

[a]NNSA did not publish a Stockpile Stewardship and Management Plan (SSMP) for fiscal year 2013. Instead, we report data from NNSA's fiscal year 2013 congressional budget justification.

[b]For the W76-1 LEP, we report the date for the end of production rather than for the first production unit because the first production unit was completed in 2008.

[c]NNSA's 2013 budget justification stated that completion of production would be discussed in the 2013 SSMP, which was never published.

[d]The "first production unit" is the first complete warhead from a production line certified for deployment.

[e]The first production unit schedule discussed is for a W88 program of smaller scope than the W88 ALT 370.

[f]The Fiscal Year 2012 SSMP included separate schedules for first production units of LEPs for the W88 and W78 warheads if a single, interoperable option was not to be pursued. The first production unit dates for these warheads were reported as 2024 and 2021, respectively.

[g]The option presented in NNSA's fiscal year 2013 congressional budget justification is for a W78 LEP.

[h]The Uranium Processing Facility construction project began as a single large project, but it was later broken up into three separately phased projects.

Earned value management is a project management tool developed by DOD in the 1960s to help managers monitor project risks. Earned value management systems measure the value of work accomplished in a given period and compare the measured value with the planned value of work scheduled for that period and the actual cost of work accomplished. Earned value management's intended purpose is to integrate a project's cost, schedule, and technical efforts for management and provide reliable data to decision makers.[24]

DOE Directives, NNSA Policy Letters, and Their Applicability to Programs

DOE's *Departmental Directives Program*, defined and established through a DOE order,[25] classifies directives into several types. These directive types include orders and guides, which the *Departmental Directives Program* describes as follows:

- **Orders.** Orders establish requirements and should include detailed instructions describing how requirements are to be implemented.
- **Guides.** Guides provide information on how to implement the requirements contained in orders. They are a nonmandatory means for complying with these requirements and cannot be made mandatory by reference in other DOE directives.

The National Nuclear Security Administration Act,[26] through which Congress established the NNSA, also gives the NNSA Administrator the authority to establish NNSA-specific policies, unless disapproved by the Secretary of Energy. NNSA does so through the issuance of policy letters. These policy letters take the form of NNSA policies, supplemental directives, and business operating procedures.

[24]GAO, *NASA: Earned Value Management Implementation across Major Spaceflight Projects Is Uneven*, GAO-13-22 (Washington, D.C.: Nov. 19, 2012).

[25]DOE Order 251.1C, *Departmental Directives Program* (Washington, D.C.: Jan. 15, 2009). This order establishes directives as the primary means to set, communicate, and institutionalize policies, requirements, responsibilities, and procedures for departmental elements and contractors.

[26]Pub. L. No. 106-65, tit. XXXII, 113 Stat. 512, 953 (1999) (codified as amended at 50 U.S.C. §§ 2401-2484 (2015)).

DOE manages the B61-12 LEP as a program. The department makes distinctions between programs and projects and uses different directives to prescribe the management approach for each, as follows:[27]

- **Programs.** According to NNSA officials, no DOE order exists that provides management requirements for program activities, such as LEPs. As we found previously in our November 2014 report on DOE and NNSA cost estimating practices, for example, DOE and NNSA programs were not required to meet any cost estimating best practices.[28] NNSA officials stated at that time that NNSA cost estimating practices for programs were limited, decentralized, and inconsistent, and were not governed by a cost estimating policy or single set of NNSA requirements and guidance. According to these officials, each NNSA program office used different practices and procedures for the development of cost estimates that were included in the NNSA annual budget.
- **Projects.** NNSA's management of projects is governed by DOE Order 413.3B (DOE's project management order). The order applies to capital asset projects above a certain cost threshold.[29] It provides management direction for NNSA and other DOE offices, with the goal of delivering projects within the original performance baseline that are fully capable of meeting mission performance and other requirements, such as environmental, safety, and health standards. The order specifies requirements that must be met, along with the documentation necessary, to move a project past major milestones. It provides requirements regarding cost estimating (and, in some cases, the preparation of an independent cost estimate), technology readiness assessments, independent project reviews, and the use of earned value management systems, among other requirements. As

[27]DOE defines a program as an organized set of activities directed toward a common purpose or goal in support of an assigned mission area, and typically includes labor and operations and maintenance costs. Programs, in turn, frequently rely on the acquisition of capital assets—through capital asset projects—to meet program needs.

[28]GAO-15-29.

[29]DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets* (Washington, D.C.: Nov. 29, 2010). The order defines a "capital asset project" in part as "a project with defined start and end points required in the acquisition of capital assets." "Capital assets" are defined in part in the order as "land, structures, equipment and intellectual property, which are used by the federal government and have an estimated useful life of 2 years or more." The order applies to capital asset projects with a total project cost of $50 million or more.

we have previously found, DOE's project management order applies to programs only in conjunction with a program's acquisition of capital assets.[30]

The Management Approach for the B61-12 LEP Informed a New NNSA Program Management Policy for Defense Programs, but Potential Challenges Remain

The B61-12 LEP's program managers have developed a management approach that was then used to inform a new NNSA policy that applies to NNSA defense program management. In addition, NNSA and DOD have identified some potential management challenges in the program; the new management approach and policy may help NNSA address these challenges, but it is too soon to evaluate the likelihood that they will adversely affect the program.

The B61-12 LEP Is Using a Management Approach That Informed New NNSA Policy for Defense Program Management

The B61-12 LEP's program managers have developed, documented, and are using program management practices and tools for the LEP to help identify and avoid cost and schedule overruns and technical issues.[31] As noted above, we have found in past reports that NNSA and DOD experienced program management challenges in LEPs, including the B61-12 LEP and the ongoing LEP for the W76 warhead.[32] We made recommendations related to NNSA's budget assumptions, cost tracking methods, and risk management plans and continue to monitor NNSA's response. Since we issued those reports, the B61-12 LEP's program managers developed a management approach for the program that draws on DOE directives and other sources, including our Cost Guide.[33] For example, we found in our November 2014 report on NNSA project and program management[34] that the B61-12 LEP's managers used our

[30]GAO-15-29.

[31]These documents include a Risk and Opportunity Management Plan, a Systems Engineering Plan, and an NNSA Project Plan.

[32]GAO-09-385 and GAO-11-387.

[33]GAO-09-3SP.

[34]GAO-15-29.

Cost Guide, as well as direction under the Phase 6.X process and DOE's project management order[35] and cost guide, to develop their approach for developing cost estimates.

Several officials from both NNSA and DOD characterized the B61-12 LEP's overall program management approach as improved over the approaches used in previous LEPs. This approach includes the following practices and tools:

- **Improved management capability and authority.** The B61-12 LEP's program office has taken steps to improve management capability and authority. According to NNSA officials, the LEP successfully requested that the department enlarge its federal program office staff to provide more management capability. Specifically, the program office had 3 full-time equivalent (FTE) staff at the beginning of the program; as of October 2015, it has 8 FTEs, augmented by contractor staff of about 12 FTEs, according to program officials. Moreover, since 2014, the federal program manager said that he has successfully requested contingency and management reserve funds of $983 million over the life of the program—about 13.5 percent of NNSA's estimated $7.3 billion total project cost—which he has authority to use to help manage the effects of realized risks or changes in funding, such as a continuing resolution.
- **An earned value management system.** According to NNSA and DOD officials we interviewed, the B61-12 LEP is the first LEP to use earned value management, a tool that may help NNSA ensure that its work progresses on budget and on schedule. Each participating NNSA site is responsible for reporting earned value data monthly against the scope, schedule, and budget baselines established for each site's activities. According to NNSA officials involved with the LEP, earned value management identifies schedule variances as they happen so that the program is aware of any work that may be progressing more slowly than expected and could go on to affect key milestones.
- **Integrated master schedules.** According to NNSA officials we interviewed, the B61-12 LEP is also the first NNSA defense program to summarize details from site schedules into a summary NNSA Integrated Master Schedule (NIMS) for work at the participating NNSA

[35]DOE Order 413.3B.

sites. The B61-12 LEP also has developed a top-level schedule that all program participants use, the Joint Integrated Master Schedule (JIMS).[36] In past LEPs, according to the officials we interviewed, NNSA did not fully reconcile and integrate its individual sites' schedules, which may have contributed to program delays and cost increases. The JIMS and other integrated master schedules are key tools in the B61-12 LEP's schedule and risk management strategy, according to officials we interviewed.

- **Integrated cost estimates.** An official from NNSA's Office of Cost Policy and Analysis told us that the B61-12 LEP is the first NNSA defense program to issue a cost estimate that integrates all participating sites' costs into a single program cost estimate. In past LEPs, according to the official, NNSA did not integrate its individual sites' cost estimates, which contributed to baseline costs being underestimated.
- **Independent cost estimate.** The official from NNSA's Office of Cost Policy and Analysis told us that the office annually prepares and publishes an independent cost estimate for the NNSA portion of the B61-12 LEP to help inform the cost estimate prepared by the B61-12 LEP program manager. This estimate is prepared without reference to the program manager's estimate and uses a different method. The estimate can then be compared to the program manager's estimate to further refine it as the program develops the formal baseline cost estimate known as the baseline cost report, one of the key steps preceding the transition to Phase 6.4. As we found in our November 2014 report on NNSA cost estimating practices, having an independent entity conduct an independent cost estimate and compare it to a project team's estimate provides an unbiased test of whether the project team's cost estimate is reasonable.[37]
- **Technology and manufacturing readiness assessments.** According to B61-12 program officials, the B61-12 program management team uses NNSA business practices to assess

[36]Specifically, the B61-12 LEP's integrated master schedules consist of (1) the NNSA Integrated Master Schedule (NIMS), which draws from all of the integrated site schedules of the participating NNSA sites; (2) the Air Force Integrated Master Schedule (AIMS), which covers activities having to do with the development of the B61-12's operational flight program software and with integration activities; (3) the Boeing Integrated Master Schedule (BIMS), which details Boeing's activities in designing and producing the tail kit assembly; and (4) the Joint Integrated Master Schedule (JIMS), the top-level schedule that all LEP participants use, which draws on inputs from the NIMS, AIMS, and BIMS.

[37]GAO-15-29.

technology and manufacturing readiness levels for the LEP.[38] The officials told us that all weapon components are maturing as planned with respect to their technology or manufacturing readiness.[39] Officials also told us that they were conservatively applying NNSA business practices and noted that some components that have been in use for years may be assessed at lower readiness levels to account for other design changes in the B61-12. In addition, NNSA is in the process of planning for a technology readiness review later in 2015 by a group of Sandia National Laboratories experts that are not otherwise part of the B61-12 LEP. We have found in previous work that such independent peer reviews can identify important technology issues.[40]

- **Peer review of the nuclear explosive package.** Nuclear weapons designers at Lawrence Livermore National Laboratory, which is not otherwise involved in the LEP, provide peer review of the nuclear explosive package components being designed at Los Alamos National Laboratory—a practice in keeping with past LEPs. Since the United States ceased nuclear explosive testing in 1992, DOE and NNSA have relied on, among other things, national laboratory peer reviews to help ensure the continued safety, reliability, and effectiveness of U.S. nuclear weapons without explosive testing. According to the official in charge of the peer review, no significant issues with the nuclear explosive package have emerged in the peer review.

About 4 years after the B61-12 LEP began, NNSA incorporated elements of the B61-12 LEP management approach into a new policy for defense program management. Specifically, in August 2014, NNSA issued its

[38]Specifically, the program uses NNSA's Defense Programs Business Process Systems Management and Operating Contractor Agreements C017 (Conduct Manufacturing Readiness Level Assessment) and C018 (Conduct Technology Readiness Level Assessment).

[39]DOD waived a technology readiness assessment for the tail kit assembly, citing the maturity of the required technology.

[40]For example, as we found in an April 2014 report, a major NNSA project that is currently under way, the Uranium Processing Facility, chartered an independent peer review team to examine various aspects of the project, including its technology readiness levels. The independent peer review team found that six of nine new technologies to be used in the facility were not as mature as previously reported in the contractor's May 2013 technology readiness level assessment. The peer review led to multiple technology development–related findings and recommendations and a corrective action plan to address them. *See* GAO, *Nuclear Weapons: Technology Development Efforts for the Uranium Processing Facility*, GAO-14-295 (Washington, D.C.: Apr. 18, 2014).

Defense Programs Program Execution Guide (Program Execution Guide) regarding program management practices in NNSA defense programs, including LEPs. It applies to all ongoing and planned LEPs, including the B61-12 LEP. NNSA officials told us that the B61-12 LEP's program management approach served as a model for many of the management practices and tools established in the Program Execution Guide. These practices include the use of earned value management systems, integrated master schedules, and risk management systems. NNSA officials told us that the name of the Program Execution Guide has created some confusion, and that it is not a DOE Guide—which provides nonmandatory means for meeting DOE requirements—but rather an NNSA policy letter.[41] To allay the confusion, the officials told us, NNSA is in the process of renaming the document the Defense Programs Program Execution Instruction. As noted above, DOE does not have an order that provides requirements for the management of programs more generally; the Program Execution Guide applies only to those programs and projects managed by NNSA's Office of Defense Programs.

The B61-12 LEP Faces Potential Management Challenges, but It Is Too Soon to Evaluate How They May Affect the Program

In undertaking its new management approach, NNSA has taken steps to address some of our prior recommendations, including drawing on our Cost Guide, but the B61-12 LEP still faces potential challenges regarding program management. The LEP's new management approach, along with practices outlined in the Program Execution Guide, may help NNSA address these challenges, but it is too soon to evaluate how the challenges may affect the LEP.

Potential challenges NNSA and DOD have identified include the following:

- **Limited management capability and authority.** According to an NNSA official, even with the increase in federal staff, NNSA needs two to three times more personnel in the federal program manager's

[41]Specifically, the Program Execution Guide is an NNSA business operating procedure, according to NNSA officials. It provides program management execution requirements and guidelines and defines the activities that are performed by federal program managers or their designees to meet requirements.

office to ensure sufficient federal management and oversight.[42] As noted above, the NNSA federal program office employs about 20 people—8 federal FTEs and about 12 FTE-equivalent contractors—to manage NNSA activities. In contrast, the Air Force office employs about 80 federal FTEs and contractors to manage Air Force activities. In addition, the November 2014 report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise raised issues about the sufficiency of NNSA program managers' authority.[43] Specifically, the report states, "Although NNSA designates government program managers for each major program, their authorities have been very limited. Most importantly, they have lacked control over resources necessary to exercise needed leadership. In practice, they could more accurately be described as program coordinators than as program managers." Similarly, in our March 2009 report, we found that NNSA's program manager for the W76 LEP did not have sufficient authority over the construction or operation of a facility that was critical to the LEP, which played a role in resulting cost and schedule overruns.[44]

- **Untested earned value management.** NNSA and DOD officials we interviewed noted that NNSA's earned value management system will be useful only insofar as good data are entered into the system and the system is used to inform program management. We have similarly noted in our Cost Guide that using earned value management represents a culture change and requires sustained management interest, as well as properly qualified and trained staff to validate and

[42]We have reported on similar challenges with NNSA staffing levels in previous reports. For example, we found in October 2014 that NNSA identified inadequate federal program oversight staff as one of the contributory causes in a design issue at its planned Uranium Production Facility (UPF). Before NNSA rescoped the project, the agency estimated it would take over $500 million and 13 months to address this issue. In order to perform more effective program oversight, NNSA increased federal staffing levels for the UPF project office from 9 full-time equivalents (FTE) in 2012 to more than 50 FTEs as of January 2014. See GAO, *Nuclear Weapons: Some Actions Have Been Taken to Address Challenges with the Uranium Processing Facility Design*, GAO-15-126 (Washington, D.C.: Oct. 10, 2014).

[43]Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Enterprise: Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise*, November 2014.

[44]GAO-09-385. We found that the construction and start-up of the facility was managed by NNSA's Y-12 National Security Complex in Oak Ridge, TN, which reported to the Y-12 Site Office, a separate organization that was not under the authority of the program manager.

interpret earned value data.[45] According to the officials we interviewed, the system is too new for them to determine conclusively whether the data are accurate and the earned value management system is being used effectively. The officials said that work to validate the data in the system is ongoing, with formal reviews to assess the quality of the system planned for 2016.

- **Cost estimating requirements and practices that have not followed best practices.** In our November 2014 report, we found that NNSA defense programs generally, and the B61-12 LEP specifically, were not required to follow cost estimating best practices.[46] For example, in that report, we found that the B61-12 LEP's team-produced guidance for the program cost estimate did not stipulate that NNSA program managers or its contractors must follow any DOE or NNSA requirements or guidance to develop the B61-12 cost estimate. We recommended in the report that DOE revise its directives that apply to programs to require that DOE and NNSA and its contractors develop cost estimates in accordance with best practices. DOE agreed with this recommendation and, in June 2015, the Secretary of Energy issued a memorandum directing the heads of all department elements to use established methods and best practices, including practices identified in our Cost Guide, to develop, maintain, and document cost estimates for capital asset projects. We note that the memorandum pertains to departmental policy related to project management, not to program management. In the area of programs, NNSA officials described actions that it had begun taking to address our recommendation regarding cost estimating practices.[47] We continue to monitor DOE's response to our recommendation.

[45]GAO-09-3SP.

[46]GAO-15-29.

[47]Specifically, according to officials in NNSA's Office of Cost Policy and Analysis, their office has issued guidance on cost estimating that draws on best practices recommended in our Cost Guide and that has become a "de facto" requirements document for cost estimating practices. For defense programs such as the B61-12 LEP, the Program Execution Guide requires programs to develop "[d]etailed [cost] estimates … to enable Earned Value Management System reporting" and to accumulate, track, and report information on "the full costs associated with [the] activity being conducted." In addition, the federal program manager noted that for the upcoming baseline cost report required for entry into phase 6.4, the B61-12 program has revised the program-specific cost estimating requirements to be consistent with best practices GAO has identified, including incorporation of independent cost estimates.

- **Guidance on technology readiness that has not followed best practices.** An NNSA business practice requires technology readiness reviews for LEPs, but it does not specify technology readiness requirements for entering into first production—Phase 6.5 of the 6.X process. Best practices followed by other federal agencies suggest and our prior recommendations state that new technologies should reach TRL 7—the level at which a prototype is demonstrated in an operational environment, has been integrated with other key supporting subsystems, and is expected to have only minor design changes—at the start of construction. In our November 2010 report, we recommended that the Secretary of Energy evaluate where DOE's guidance for gauging the maturity of new technologies is inconsistent with best practices and, as appropriate, revise the guidance to be consistent with federal agency best practices.[48] DOE generally agreed with our recommendation. Concerning projects, in his June 2015 memorandum, the Secretary of Energy directed that critical technologies should reach TRL 7 before major system projects—those with a total cost of greater than $750 million—receive approval of their performance baselines.[49] Concerning programs, NNSA officials told us they recently issued technology readiness assessment guidance that was not used in the B61-12 LEP but will be used in the W80-4 and Interoperable Warhead LEPs.

The new management approach that the B61-12 LEP's program managers have implemented, along with the new Program Execution Guide, may help NNSA address the potential management challenges that NNSA officials and others have identified with previous LEPs, but it is too soon to determine whether this will be the case.

[48]GAO, *Nuclear Weapons: National Nuclear Security Administration's Plans for Its Uranium Processing Facility Should Better Reflect Funding Estimates and Technology Readiness*, GAO-11-103 (Washington, D.C.: Nov. 19, 2010).

[49]Specifically, the June 2015 memorandum stated that major system projects should achieve TRL 7 before critical decision (CD) 2—the milestone signaling that definitive scope, schedule, and cost baselines have been developed—"for each critical technology item or system as determined by an independent review team outside of the project team before that CD can be approved."

NNSA and the Air Force Have Risk Management Plans for the B61-12 LEP, but Managing Future Risks May Be Challenging Because the LEP Schedule Is Constrained

NNSA and the Air Force have instituted a process to identify risks within the B61-12 LEP and develop plans to manage those risks. However, a constrained development and production schedule—driven by the aging of legacy B61 bombs and the need to start work on other LEPs, among other factors—could complicate risk management efforts.

NNSA and the Air Force Have Instituted a Process to Identify and Manage Risks

According to NNSA and Air Force officials, the B61-12 LEP risk analysis and management approach uses the program's integrated master schedules in conjunction with a risk register, the Active Risk Manager database. Specifically, the LEP's 48 product realization teams (PRT)—the groups of scientists, engineers, and subject-matter experts that perform the ground-level project work on B61-12 components and subassemblies—are responsible for identifying risks. Most risks are managed at the PRT level, but risks that have the potential to affect top-level schedule milestones or the program's ability to deliver a weapon that meets performance requirements are presented to joint review boards for inclusion in the Active Risk Manager database. These higher-level risks—referred to as joint risks—are categorized according to the likelihood of their occurrence and the consequences should they occur. Joint risks with the highest likelihood and consequence are color coded as "red" risks, with successively lower-likelihood and –consequence risks labeled as "yellow" and "green," respectively. Program officials develop risk management steps for each joint risk, document and make time for these steps in both the Active Risk Manager database and the relevant integrated master schedules, and brief the Nuclear Weapons Council on the status of joint risks. Additionally, NNSA identifies and documents opportunities—program areas with the potential to realize saved time and cost.

According to NNSA and Air Force officials, some of the joint risks identified through this process have already been successfully managed. For example, NNSA officials told us that they were able to avoid the risk of a shortage of a type of glass necessary for electrical connections by procuring the glass for the entire program in advance. NNSA estimates

that avoiding this risk prevented a program delay that could have lasted for more than a year and increased program costs by more than $2 million.

Other joint risks may affect later stages of the B61-12 LEP, so it is too soon to tell if plans to manage them will be effective. Joint risks in the "red" category (i.e., high risk) include risks related to the compatibility of the B61-12 with the still-developing F-35 aircraft, the risk of temperature-related component failures in certain flight environments, and schedule risks related to the hydrodynamic testing of certain changed nonnuclear components.[50] In November 2015, the federal program manager for the LEP reported that these risks remain "red" but are "trending" in a positive direction. Based on our discussions with program officials and our review of NNSA and Air Force documentation, the steps necessary to manage these and other risks will occur over several years.

Agencies' Management of Future Program Risks May Be Complicated by the LEP's Constrained Schedule

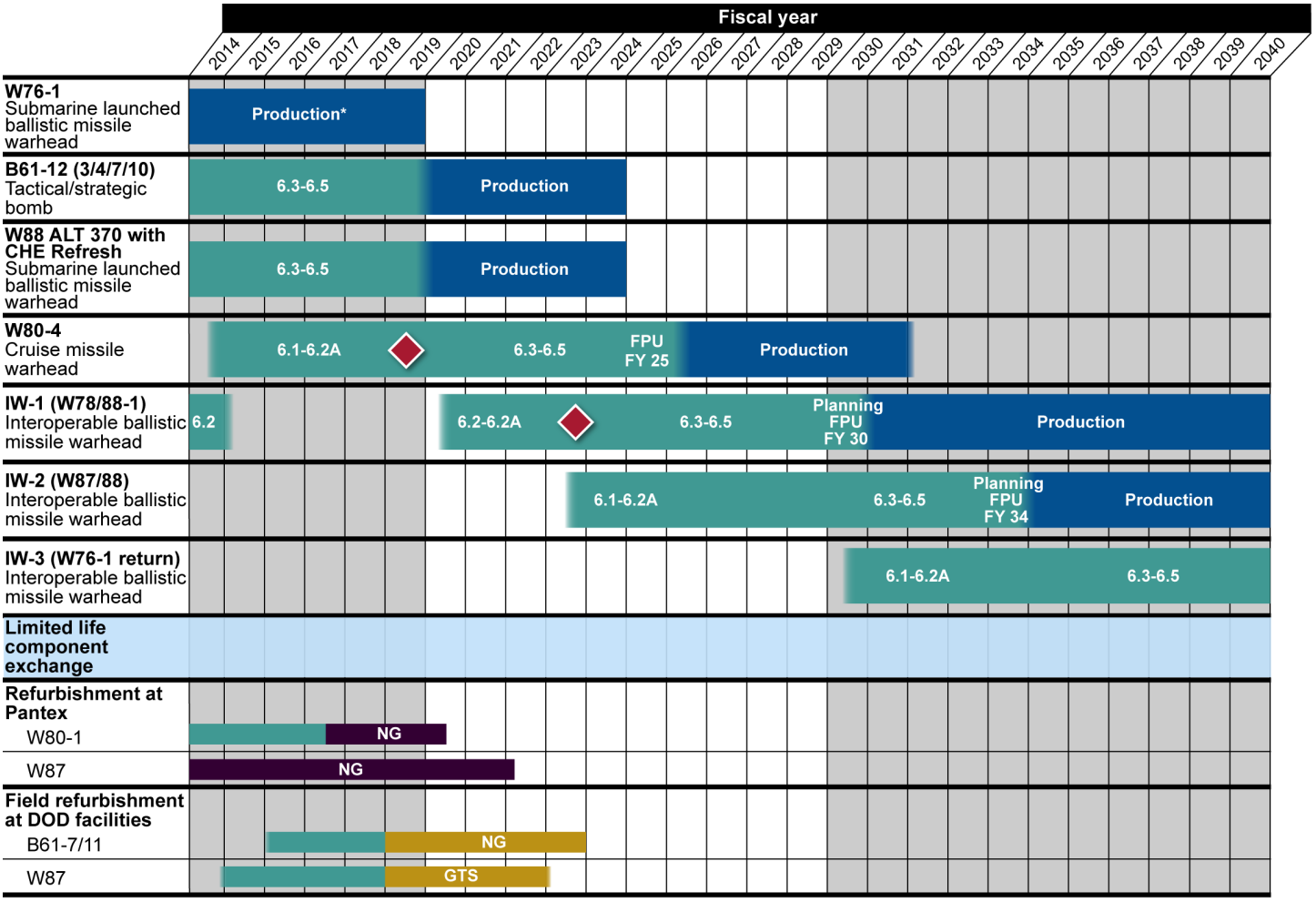
Complicating efforts to manage future LEP risks—especially if risks are realized or new ones materialize—is a constrained development and production schedule. NNSA and DOD officials acknowledged the schedule's constraints, which they say are driven by factors including delays in starting the B61-12 LEP because of a lengthy design study, the effects of sequestration,[51] and the need to complete work on the B61-12 LEP to enable NNSA to start work on planned future LEPs. In testimony given to the Strategic Forces Subcommittee of the Senate Committee on Armed Services in March 2015, the Nuclear Weapons Council characterized the B61-12 LEP's schedule as having "little, if any, margin left." DOD officials have testified before Congress that the B61-12 LEP must be completed on the current schedule to ensure that the aging of B61 legacy bombs does not affect the United States' ability to maintain its

[50]During hydrodynamic testing, scientists evaluate weapon characteristics by detonating a "mockup" of a pit, which is the primary stage of a nuclear weapons system. The mockup uses high explosives and a nonfissile surrogate material that has similar properties to plutonium. The mock implosion is called a hydrodynamic test (or hydrotest) because the surrogate fuel and other components become hot enough to flow like water.

[51]On March 1, 2013, pursuant to the Balanced Budget and Emergency Deficit Control Act of 1985 (Pub. L. No. 99-177) as amended by the Budget Control Act of 2011 (Pub. L. No. 112-25), the President ordered spending reductions known as sequestration across the federal government. *See*, e.g., GAO, *Sequestration: Documenting and Assessing Lessons Learned Would Assist DOD in Planning for Future Budget Uncertainty*, GAO-15-470 (Washington, D.C.: May 27, 2015).

commitments to NATO, and DOE officials have testified that the LEP must be completed to ensure that DOE can effectively manage other ongoing and planned LEPs and stockpile stewardship activities. These activities are set to intensify in the coming years. For example, according to NNSA documents, NNSA plans to execute at least four LEPs per year simultaneously in fiscal years 2021 through 2025—along with several major construction projects, including efforts to modernize NNSA's uranium and plutonium capabilities. Figure 3 shows the schedules for NNSA's planned LEPs and major alterations.

Figure 3: Schedules for Planned Stockpile Life Extension Programs and Major Alterations in the National Nuclear Security Administration's 2016 Budget Materials



Source: GAO analysis of National Nuclear Security Administration data. | GAO-16-218

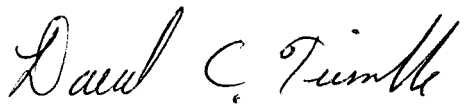
Given NNSA's past problems in executing LEPs, and a schedule with little room for delays, NNSA and Air Force may face challenges in the future in ensuring that risks are not realized and do not affect the program's schedule, its cost, or the performance of the B61-12. We will continue to assess the B61-12 LEP as it passes through later stages of the Phase 6.X process, in keeping with the Senate report provision that gave rise to this report.

Agency Comments and Our Evaluation

We are not making new recommendations in this report. We provided a draft of this report to DOE and DOD for review and comment. In its written comments, reproduced in appendix II, DOE generally agreed with our findings. DOD did not provide formal comments. Both agencies provided technical comments that we incorporated, as appropriate.

We are sending copies of this report to the appropriate congressional committees, the Secretary of Energy, the Secretary of Defense, and other interested parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff members have any questions about this report, please contact me at (202) 512-3841 or trimbled@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix III.



David C. Trimble
Director, Natural Resources and Environment

Appendix I: Objectives, Scope, and Methodology

This report assesses (1) the Department of Energy's (DOE) National Nuclear Security Administration's (NNSA) management approach for the B61-12 Life Extension Program (LEP) and (2) the extent to which NNSA and the Air Force are managing risks in the LEP.

To assess NNSA's management approach for the B61-12 LEP, we reviewed the program-developed documents that establish cost and schedule goals and track the program's progress toward those goals. These documents included the program's Joint Integrated Project Plan, Joint Top-level Schedule, Master Schedule, and Selected Acquisition Reports. In addition, we reviewed other program-developed guidance documents that the program management team prepared for the B61-12 LEP. These included the Integrated Phase Gate Implementation Plan, Project Controls System Description, Systems Engineering Plan, Quality Plan, and Configuration Management Plan. We also reviewed the Procedural Guideline for the Phase 6.X Process,[1] which describes the roles and functions of DOE, the Department of Defense (DOD), and the Nuclear Weapons Council in nuclear weapon refurbishment activities such as the B61-12 LEP. In addition, we examined DOE and DOD directives and NNSA policy letters to understand departmental requirements for the management of the LEP. For DOE, these included DOE Order 251.1C, *Departmental Directives Program*;[2] DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*;[3] DOE Guide 413.3-4A, *Technology Readiness Assessment Guide*[4]; and NNSA's Defense Programs Program Execution Guide.[5] For DOD, these included DOD Instruction 5000.02, *Operation of the Defense Acquisition System*[6], and DOD Instruction 5030.55, *DoD Procedures for*

[1]DOD and DOE, *Procedural Guideline for the Phase 6.X Process* (Washington, D.C.: Apr. 19, 2000).

[2]DOE Order 251.1C, *Departmental Directives Program* (Washington, D.C.: Jan. 15, 2009).

[3]DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets* (Washington, D.C.: Nov. 29, 2010).

[4]DOE Guide 413.3-4A, *Technology Readiness Assessment Guide* (Washington, D.C.: Sept. 15, 2011).

[5]DOE, *Department of Energy National Nuclear Security Administration Office of Defense Programs DP Program Execution Guide* (Washington, D.C.: July 31, 2014).

[6]DOD, Department of Defense Instruction 5000.02, *Operation of the Defense Acquisition System* (Washington, D.C.: Jan. 7, 2015).

Joint DoD-DOE Nuclear Weapons Life-Cycle Activities.[7] For information on the management of the B61-12 LEP in the broader context of joint DOE-DOD stockpile stewardship activities, we also reviewed documents such as DOD's *Nuclear Posture Review Report* of 2010[8] and DOE's *Stockpile Stewardship and Management Plan*.[9]

To assess the extent to which NNSA and the Air Force are managing risks in the LEP, we reviewed the documents described above. In addition, we visited NNSA's Sandia National Laboratories and Los Alamos National Laboratory to view systems that track project activities, cost and schedule information, and the execution of risk management steps, as well as to meet program officials responsible for the design and production of the B61-12 and see some of the components under development. The systems we reviewed included the B61-12 LEP's Active Risk Manager database and the systems holding classified elements of project plans and schedules.

For both objectives, in the course of our site visits to the laboratories named above, we interviewed federal officials and contractors involved with the B61-12 LEP. We also interviewed officials in NNSA offices responsible for providing guidance, oversight, and program review for the B61-12 LEP and other such defense programs. For criteria and context, we used the GAO Cost Estimating and Assessment Guide[10] and our past reports on LEPs and NNSA cost estimating practices.[11] Throughout our work, we coordinated with a team from DOE's Office of Inspector General, which is conducting its own review of the B61-12 LEP and plans to issue a classified report.

We conducted this work from July 2014 to January 2016 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate

[7]DOD, DOD Instruction 5030.55, *DoD Procedures for Joint DoD-DOE Nuclear Weapons Life-Cycle Activities* (Washington, D.C.: Jan. 25, 2001).

[8]DOD, *Nuclear Posture Review Report* (Washington, D.C: Apr. 2010).

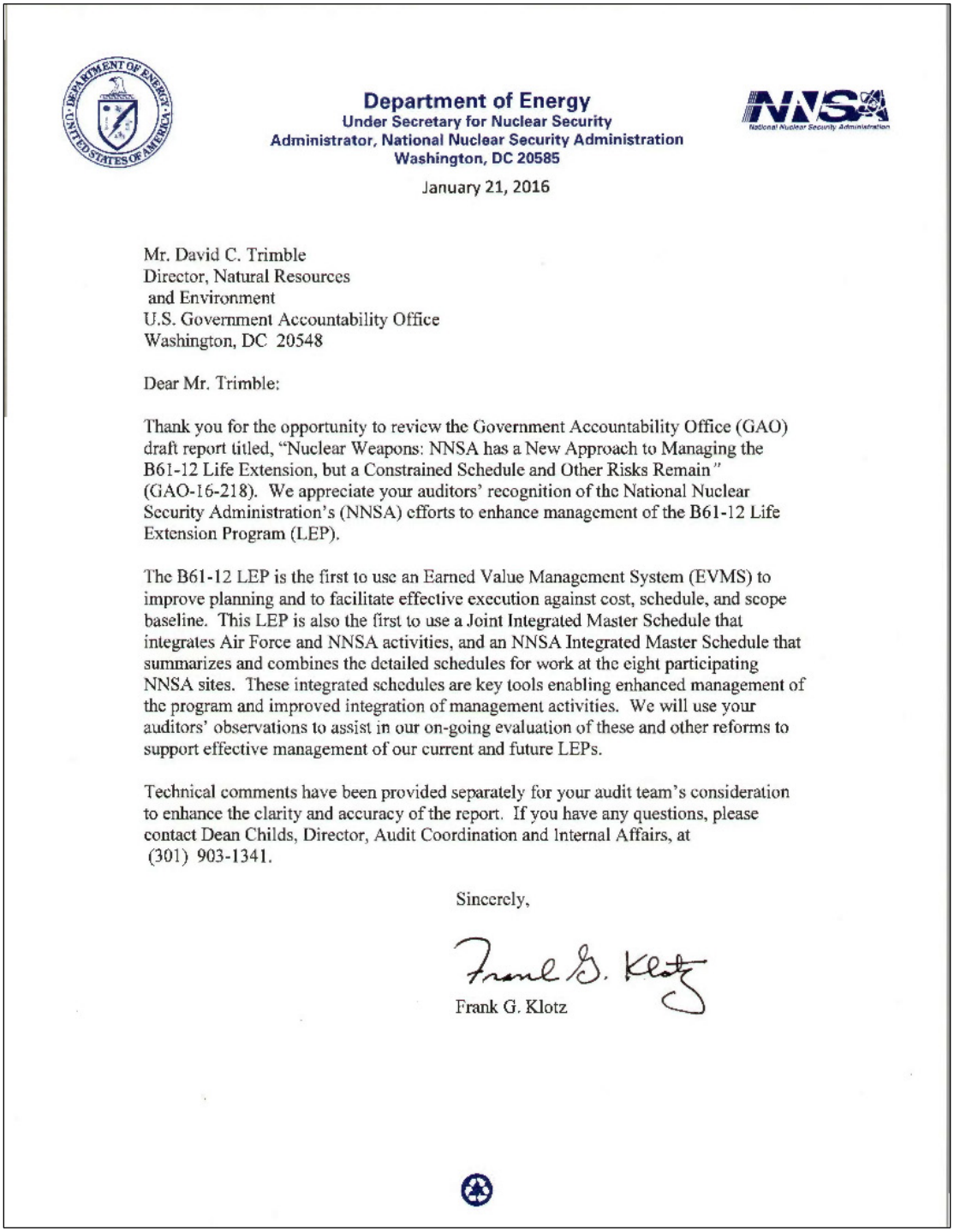
[9]DOE, *Fiscal Year 2016 Stockpile Stewardship and Management Plan* (Washington, D.C.: March 2015).

[10]GAO-09-3SP.

[11]GAO-09-385, GAO-11-387, and GAO-15-29.

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 Energy



Department of Energy
Under Secretary for Nuclear Security
Administrator, National Nuclear Security Administration
Washington, DC 20585

January 21, 2016

Mr. David C. Trimble
Director, Natural Resources
and Environment
U.S. Government Accountability Office
Washington, DC 20548

Dear Mr. Trimble:

Thank you for the opportunity to review the Government Accountability Office (GAO) draft report titled, "Nuclear Weapons: NNSA has a New Approach to Managing the B61-12 Life Extension, but a Constrained Schedule and Other Risks Remain" (GAO-16-218). We appreciate your auditors' recognition of the National Nuclear Security Administration's (NNSA) efforts to enhance management of the B61-12 Life Extension Program (LEP).

The B61-12 LEP is the first to use an Earned Value Management System (EVMS) to improve planning and to facilitate effective execution against cost, schedule, and scope baseline. This LEP is also the first to use a Joint Integrated Master Schedule that integrates Air Force and NNSA activities, and an NNSA Integrated Master Schedule that summarizes and combines the detailed schedules for work at the eight participating NNSA sites. These integrated schedules are key tools enabling enhanced management of the program and improved integration of management activities. We will use your auditors' observations to assist in our on-going evaluation of these and other reforms to support effective management of our current and future LEPs.

Technical comments have been provided separately for your audit team's consideration to enhance the clarity and accuracy of the report. If you have any questions, please contact Dean Childs, Director, Audit Coordination and Internal Affairs, at (301) 903-1341.

Sincerely,

Frank G. Klotz

Frank G. Klotz

Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

David C. Trimble, (202) 512-3841 or trimbled@gao.gov

Staff Acknowledgments

In addition to the individual named above, Jonathan Gill (Assistant Director), Antoinette C. Capaccio, Penney Harwell Caramia, Pamela Davidson, Dan Feehan, Alex Galuten, Jennifer Gould, Rob Grace, Alison O'Neill, Tim Persons, Ron Schwenn, Sara Sullivan, and Kiki Theodoropoulos made key contributions to this report.

GAO's Mission

The Government Accountability Office, the audit, evaluation, and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through GAO's website (http://www.gao.gov). Each weekday afternoon, GAO posts on its website newly released reports, testimony, and correspondence. To have GAO e-mail you a list of newly posted products, go to http://www.gao.gov and select "E-mail Updates."

Order by Phone

The price of each GAO publication reflects GAO's actual cost of production and distribution and depends on the number of pages in the publication and whether the publication is printed in color or black and white. Pricing and ordering information is posted on GAO's website, http://www.gao.gov/ordering.htm.

Place orders by calling (202) 512-6000, toll free (866) 801-7077, or TDD (202) 512-2537.

Orders may be paid for using American Express, Discover Card, MasterCard, Visa, check, or money order. Call for additional information.

Connect with GAO

Connect with GAO on Facebook, Flickr, Twitter, and YouTube.
Subscribe to our RSS Feeds or E-mail Updates.
Listen to our Podcasts and read The Watchblog.
Visit GAO on the web at www.gao.gov.

To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Website: http://www.gao.gov/fraudnet/fraudnet.htm
E-mail: fraudnet@gao.gov
Automated answering system: (800) 424-5454 or (202) 512-7470

Congressional Relations

Katherine Siggerud, Managing Director, siggerudk@gao.gov, (202) 512-4400, U.S. Government Accountability Office, 441 G Street NW, Room 7125, Washington, DC 20548

Public Affairs

Chuck Young, Managing Director, youngc1@gao.gov, (202) 512-4800
U.S. Government Accountability Office, 441 G Street NW, Room 7149
Washington, DC 20548