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Energy and Water Development Appropriations: Nuclear Weapons Activities

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Summary

The annual Energy and Water Development appropriations bill funds civil works projects of the Army Corps of Engineers, the Department of the Interior's Bureau of Reclamation, the Department of Energy (DOE), and several independent agencies. The DOE budget funds the National Nuclear Security Administration (NNSA), a semiautonomous agency within DOE. NNSA operates three programs: Defense Nuclear Nonproliferation, Naval Reactors, and Weapons Activities. The last is the subject of this report.

The Weapons Activities account supports U.S. nuclear warheads, provides the materials and components for those weapons, and sustains the infrastructure that supports that mission. They provide for "the maintenance and refurbishment of nuclear weapons to continue sustained confidence in their safety, reliability, and performance; continued investment in scientific, engineering, and manufacturing capabilities to enable production and certification of the enduring nuclear weapons stockpile; and manufacture of nuclear weapon components."

NNSA's budget request for FY2021 sought $15.6 billion for Weapons Activities, an increase of 25% over the enacted funding of $12.6 billion in FY2020, within a total budget of $19.8 billion for NNSA. Congress provided $15.3 billion in H.R. 133, the Consolidated Appropriations Act, 2021.

NNSA has reorganized and renamed its programs areas in its FY2021 budget request. The four main programs, each with a request of over $2 billion for FY2021, include the following:

- Stockpile Management contains many of the projects included in Directed Stockpile Work from previous years. It supports work directly on nuclear weapons, including life extension programs, warhead surveillance, maintenance, and other activities. The FY2020 appropriation for Directed Stockpile Work that will now be a part of Stockpile Management was $3.7 billion. NNSA requested $4.8 billion, and Congress appropriated $4.9 for them in FY2021.
- Production Modernization programs focus on maintaining and expanding the production capabilities for the components of nuclear weapons. According to NNSA, these include primaries, canned subassemblies, radiation cases, and non-nuclear components. The FY2020 appropriation for programs that are now included in this program area was $1.6 billion; NNSA requested $2.45 billion, and Congress appropriated $2.54 billion for them in FY2021.
- Stockpile Research, Technology, and Engineering replaces the Research, Development, Test and Evaluation program area. These programs provide the scientific foundation for science-based stockpile decisions. The FY2020 appropriation for programs that are now included in this program area was $2.6 billion. NNSA requested, and Congress provided, $2.8 billion in FY2021.
- Infrastructure and Operations maintains, operates, and modernizes the NNSA infrastructure. It supports construction of new facilities and funds deferred maintenance in older facilities. The FY2020 appropriation for programs that are now included in this program area was $3.2 billion. NNSA requested $4.4 billion for FY2021; Congress appropriated $4.1 billion.

Weapons Activities also includes several smaller programs, all of which are described in this report: Secure Transportation Asset, Defense Nuclear Security, Information Technology and Cybersecurity, and Legacy Contractor Pensions.

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Overview

The Nuclear Security Enterprise

Responsibility for U.S. nuclear weapons resides with both the Department of Defense (DOD) and the Department of Energy (DOE). DOD develops, deploys, and operates the missiles and aircraft that can deliver nuclear warheads. It also generates the military requirements for the warheads carried on those platforms. The National Nuclear Security Administration (NNSA), a semiautonomous agency within the Department of Energy, oversees the research, development, test, and acquisition programs that produce, maintain, and sustain the warheads. NNSA is also responsible for storing and securing the warheads that are not deployed with DOD delivery systems and for dismantling warheads that have been retired and removed from the stockpile.

Congress authorizes funding for both DOD and NNSA nuclear weapons activities in the annual National Defense Authorization Act (NDAA); it funds the NNSA budget through the Energy and Water Development Appropriations Act. This report focuses on the portion of the Energy and Water Development Appropriations Act that funds NNSA's nuclear weapons activities.

Reorganization of the Nuclear Security Enterprise

During World War II, when the United States first developed nuclear weapons, the Army managed the nuclear weapons program. In 1946, Congress passed the Atomic Energy Act of 1946 to establish the Atomic Energy Commission (AEC). The AEC was an independent civilian agency tasked with managing the U.S. nuclear weapons program. In the Energy Research and Development Act of 1974, Congress dissolved the AEC and created the Nuclear Regulatory Commission and the Energy Research and Development Administration (ERDA), which among other functions managed the nuclear weapons program. That program was moved again by the Department of Energy Organization Act of 1977, which dissolved ERDA and created DOE.[1]

Congress, in passing the National Defense Authorization Act for Fiscal Year 2000 (P.L. 106-65, Title XXXII), established the semiautonomous National Nuclear Security Administration. In addition to managing the nuclear weapons program, NNSA also manages the Defense Nuclear Nonproliferation and Naval Reactors programs.

These reorganizations stem, in part, from long-standing concerns about the management of the nuclear weapons complex. Many reports and legislative provisions have been written over the past several decades to address this issue.[2] Congress has also expressed concerns about cost growth and transparency in NNSA's programs. These concerns have focused on both major construction projects and weapons refurbishment programs. Congress may continue to focus on cost growth and program management as it reviews NNSA's budget request for FY2021; NNSA has requested a 25% increase in its FY2021 budget for Weapons Activities.

[1] For a history of the nuclear weapons program and related topics, 1939-2010, see U.S. Department of Energy, National Nuclear Security Administration, "NNSA Timeline," https://www.energy.gov/articles/history-energy-departments-role-nuclear-security.

[2] Most recently, in the National Defense Authorization Act for Fiscal Year 2013 (P.L. 112-239), Congress established the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise and directed the panel to make recommendations on "the most appropriate governance structure, mission, and management of the nuclear security enterprise." Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, "A New Foundation for the Nuclear Enterprise," November 2014, pp. ix-x, http://cdn.knoxblogs.com/atomiccity/wp-content/uploads/sites/11/2014/12/Governance.pdf?ga=1.83182294.1320535883.1415285934.

The Nuclear Weapons Complex

At the end of the Cold War in 1991, the U.S. nuclear weapons complex consisted of 14 sites—3 laboratories, the nuclear weapons test site in Nevada, and a number of manufacturing plants for weapons materials and components. As the number of nuclear weapons in the U.S. arsenal declined and demand for new warheads and materials abated in the 1990s, the United States closed several facilities in the complex.

The complex now consists of eight sites in seven states. These sites include three laboratories (Los Alamos National Laboratory, NM; Lawrence Livermore National Laboratory, CA; and Sandia National Laboratories, NM and CA); four production sites (Kansas City Plant, MO; Pantex Plant, TX; Savannah River Site, SC; and Y-12 National Security Complex, TN); and the Nevada National Security Site (formerly Nevada Test Site). NNSA manages and sets policy for the complex; contractors operate the eight sites.[3]

Funding Trends Since 2010

The Obama Administration requested increased funding for the nuclear weapons complex in each of its annual budgets. In an editorial published in January 2010, Vice President Biden noted that U.S. nuclear laboratories and facilities had been "underfunded and undervalued" for more than a decade.[4] He stated that the President's budget request for FY2011 would include "$7 billion for maintaining our nuclear-weapons stockpile and complex, and for related efforts," an amount that was $600 million more than Congress appropriated for FY2010. He also stated that the Administration would "boost funding for these important activities by more than $5 billion" over the next five years. Although the passage of the Budget Control Act in late 2011 slowed the increases in NNSA budgets, as is evident in the figure below, the actual appropriations for NNSA's weapons activities have begun to exceed the 10-year expectations outlined in 2010.

The Obama Administration outlined a 10-year projection of its funding plans for the nuclear weapons enterprise in a May 2010 report to Congress, known as the "1251 report," in support of the ratification of the New START Treaty.[5] In the November 2010 update of that document, the Obama Administration projected weapons stockpile and infrastructure costs for FY2011-FY2021 at between $85.4 billion and $86.2 billion. As shown in **Figure 1**, funds appropriated for these programs fell below the projected levels early in the decade, after passage of the Budget Control Act. However, beginning in FY2017, NNSA budget requests have exceeded the amount predicted in the 2010 report, in response to policy decisions and growing program requirements.

The Trump Administration has continued to increase funding for NNSA's budget for Weapons Activities, above both the level expected in the 1251 report and the level projected in earlier NNSA budgets. In its budget for FY2018, the Trump Administration requested an additional $1 billion for NNSA weapons activities over the level appropriated in FY2017. While the Administration had indicated that this increase would support both accumulated deferred maintenance requirements at NNSA weapons facilities and ongoing warhead life extension programs, it continued to direct funding to the higher-priority life extension programs while

[3] For details on the sites in the Nuclear Weapons Complex, see CRS Report R45306, *The U.S. Nuclear Weapons Complex: Overview of Department of Energy Sites*, by Amy F. Woolf and James D. Werner.

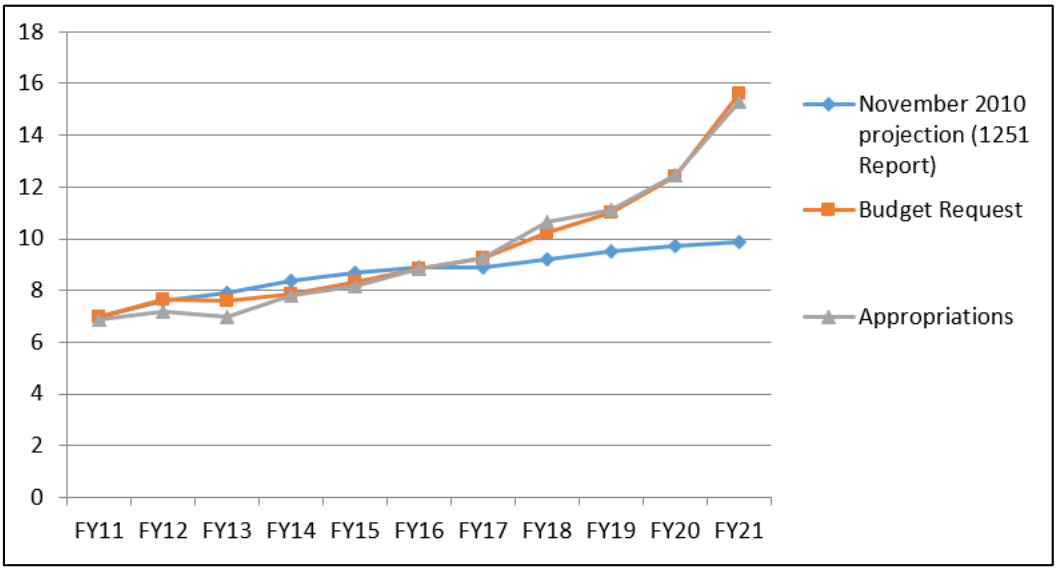
[4] Joe Biden, "The President's Nuclear Vision," *Wall Street Journal*, January 29, 2010.

[5] Congress had requested this report in the National Defense Authorization Act for Fiscal Year 2010 (P.L. 111-84), Section 1251, and mandated that it outline a comprehensive plan to "(1) maintain delivery platforms [that is, bombers, missiles, and submarines that deliver nuclear weapons]; (2) sustain a safe, secure, and reliable U.S. nuclear weapons stockpile; and (3) modernize the nuclear weapons complex."

funding for deferred maintenance remained essentially unchanged. Most of the increases in the funding request for FY2018 divided between the life extension programs and research and development activities. Congress enacted a budget of $10.642 billion for weapons activities for NNSA in FY2018, in the Consolidated Appropriations Act, 2018 (P.L. 115-141).

Figure 1. Funding for NNSA Nuclear Weapons Activities

Projected, Requested, and Appropriated, FY2011-FY2021 (billions of current dollars)



Sources: NNSA budget requests, congressional appropriations reports, CRS estimates.

The Trump Administration's budget for FY2019 requested $11.02 billion, an increase of nearly $400 million over the funding enacted in FY2018. Congress enacted a budget of $11.1 billion for weapons activities in the Energy and Water, Legislative Branch, and Military Construction and Veterans Affairs Appropriations Act, 2019 (P.L. 115-244). The FY2020 budget requested $12.4 billion, an increase of $1.3 billion (12%) over the funding enacted in 2019. The House Energy and Water Appropriations Subcommittee recommended $11.7 billion—$660.8 million above the funding enacted for FY2019, but $647.8 million below the budget request for FY2020 (H.R. 2960, H.Rept. 116-83), while the Senate Energy and Water Appropriations Subcommittee recommended $12.7 billion (S. 2470, S.Rept. 116-102). Congress appropriated $12.5 billion in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94).

In its FY2020 budget documents, NNSA projected that it would request $12.8 billion for Weapons Activities in FY2021, within a total budget of $16.9 billion for NNSA. The FY2021 budget request, however, sought $15.6 billion for Weapons Activities within a total of $19.8 billion for NNSA. This would amount to a 25% increase in funding for Weapons Activities and an 18% increase in funding for NNSA over the amount appropriated in FY2020 and a 21% increase in funding for Weapons Activities and a 17% increase in funding for NNSA over the amount NNSA expected to request for FY2021. The House approved $13.7 billion for Weapons Activities in its version of the FY2021 Energy and Water Development appropriations bill (H.R. 7613, H.Rept. 116-449). While this would be an increase of $1.203 billion (10%) over the amount appropriated in FY2020, it is a reduction of $1.942 billion from the FY2021 budget request. Congress, however, appropriated $15.3 billion in H.R. 133, the Consolidated Appropriations Act for 2021.

Press reports indicate that the Office of Management and Budget initially reduced NNSA's request for FY2021 from $19.6 billion to $18.6 billion, with the White House cutting it further to $17.5 billion.[6] However, reportedly after some Members of Congress appealed to the President, the White House approved the request for $19.6 billion for NNSA in FY2021.[7]

In a hearing before the Strategic Forces Subcommittee of the House Armed Services Committee on March 3, 2020, Lisa Gordon-Hagerty, the Administrator of NNSA, outlined the goals for the increased funding:

> The weapons activities request of $15.6 billion will allow us to modernize the nation's nuclear weapons stockpile and infrastructure and meet national security requirements after several decades of neglect. It will modernize the stockpile with five weapons modernization programs, execute stockpile sustainment activities, and conduct annual assessment activities on all weapon systems. With this request, we will continue the dismantlement and disposition of weapons and components from weapons retired from the stockpile and support production modernization activities for nonnuclear components and strategic materials, including a two-site plutonium pit strategy. We will also continue to recapitalize NNSA's aging infrastructure, including the Y12 uranium processing facility, the NNSS U1A complex enhancements project, and the high explosive science and engineering facility at Pantex.

She noted that NNSA had not asked for or expected this level of funding in the FY2020 budget request because "we have budget caps and we were operating other—under other situations." She stated that the FY2021 budget request is "a realistic number to get us to resolve the decades-long neglect that has been applied to NNSA and our enterprises."[8]

While this explanation focused on the need to pursue modernization programs across the NNSA portfolio, press reports indicate that the magnitude of the budget increase was not just a result of the scope of the effort. According to these reports, "internal government documents show the raise is devoted substantially to covering previously undisclosed cost overruns" and to avoid "years of new delays in the majority of U.S. atomic weapons programs." Consequently, "the additional funds are needed not so much to advance capabilities as merely to keep troubled programs from falling further behind."[9]

During the March 3 House Armed Services Committee hearing, Allison Bawden of the Government Accountability Office raised concerns about the size and scope of NNSA's FY2021 budget request. She noted that "the nuclear security enterprise is embarking on its most ambitious level of effort since the Cold War era, and NNSA is currently managing four weapon modernization programs, proposing a fifth, and undertaking infrastructure projects that affect every strategic material and component used in nuclear weapons." She stated that it was important for NNSA to set "priorities among its efforts in the event of budget shortfalls or cost or

[6] Steve Hayes, "Budget Squabble Threatens U.S. Nuclear Modernization Efforts," *The Dispatch*, January 21, 2020, https://thedispatch.com/p/budget-squabble-threatens-us-nuclear.

[7] Joe Gould, "Trump will seek 20% budget boost for nukes, says Inhofe," *Defense News*, January 28, 2019, https://www.defensenews.com/congress/2020/01/28/trump-will-seek-20-budget-boost-for-nukes-says-inhofe/?utm_source=Sailthru&utm_medium=email&utm_campaign=EBB%2001.29.20&utm_term=Editorial%20-%20Early%20Bird%20Brief.

[8] U.S. Congress, House Committee on Armed Services, Subcommittee on Strategic Forces, *Fiscal 2021 Budget Request for the Nuclear Forces and Atomic Energy Defense Activities*, Hearing, 116th Cong., 2nd sess., March 3, 2020.

[9] John M. Donnelly, "Undisclosed delays plague atomic programs, cost billions to fix," *Congressional Quarterly*, March 19, 2020, https://plus.cq.com/doc/news-5863379?0&searchId=4tcMmrz2.

schedule overruns" and raised several concerns about the existing program and schedule. She noted, among other concerns, that

- because "NNSA's modernization program is highly integrated, any delay could have a significant cascading effect on the overall effort";
- the "construction scheduled for pit facilities is aggressive, and a delay could have an impact on the schedule for the weapons programs it supports"; and
- "because NNSA uses the same production infrastructure for each weapon program and capacity is limited, each program's schedule can impact the next."[10]

Managing the Nuclear Weapons Stockpile

The United States conducted 1,054 nuclear weapons test explosions between 1945 and 1992. These were the primary means by which the United States both determined whether its nuclear weapons designs would work and confirmed that the weapons remained reliable and effective as they aged. In 1992, Congress enacted a moratorium on U.S. nuclear weapons testing when it attached the Hatfield-Exon-Mitchell amendment to the Energy and Water Development Appropriations Act, 1993.[11] President George H. W. Bush signed the bill into law (P.L. 102-377) on October 2, 1992.

In the absence of nuclear weapons testing, the United States uses a science-based program to maintain and sustain confidence in the reliability of the nuclear stockpile. Congress established the Stockpile Stewardship Program in the National Defense Authorization Act for Fiscal Year 1994 (P.L. 103-160). This program, as amended by the National Defense Authorization Act for Fiscal Year 2010 (P.L. 111-84, §3111), is to ensure "that the nuclear weapons stockpile is safe, secure, and reliable without the use of underground nuclear weapons testing."

NNSA implements the Stockpile Stewardship Program through the activities funded by Weapons Activities account in the NNSA budget. Prior to this budget year, the account included three major program areas, each with a budget in excess of $2 billion, and several smaller programs. The aggregate funding for these programs appears in **Table 1**, below.

In the FY2021 budget request, NNSA reorganized the Weapons Activities account and renamed some of its main programs areas. The four largest program areas, each with a request of over $2 billion for FY2021, include Stockpile Management; Production Modernization; Stockpile Research, Technology, and Engineering; and Infrastructure and Operations. **Table 2** displays the FY2020 enacted funding for the prior program areas and the FY2021 funding request for the new program areas; it also displays the comparable funding amount for these program areas if NNSA had requested funding according to this organization in FY2020. The House rejected some of these proposed changes in the structure of the Weapons Activities programs, noting in the appropriations committee report (H.Rept. 116-449) that, although NNSA had sought "to engage in a constructive and transparent manner in communicating the proposed changes," the committee "believes additional oversight and monitoring is necessary." Congress, however, provided appropriations according to the new program areas in H.R. 133, the Consolidated Appropriations Act, 2021.

[10] Ibid.

[11] This amendment banned testing before July 1, 1993, set conditions on a resumption of testing, and then banned testing after September 1996 unless another nation tested. The United States signed the Comprehensive Test Ban Treaty, which banned all nuclear explosive tests. Although Congress voted against giving its consent to ratification of this Treaty in 1999, and the Treaty has not yet entered into force, the United States continues to observe a moratorium on nuclear explosive testing.

Table 1. Funding for Weapons Activities, FY2017-FY2020

(millions of current dollars)

Program	FY2017 Enacted	FY2018 Request	FY2018 Enacted	FY2019 Request	FY2019 Enacted	FY2020 Request	FY2020 Enacted
DSW	3,308.3	3977.0	4,009.4	4,666.2	4,658.2	5,426	5,449
RDT&E Programs	1,842.2	2028.3	2,034.4	1,995.4	2,014.2	2,278	2,398
I&O	2,808.4	2803.1	3,117.8	3,002.7	3,087.9	3,208	3,151
Other[a]	1,359.5	1430.8	1,480.5	1352.8	1,339.7	1,497	1,459
Total	9,318,1	10,239.2	10,642.1	11,017.1	11,100.0	12,409	12,457

Sources: NNSA Congressional Budget Requests, House and Senate Appropriations Committee reports.

Notes: Details may not add to totals due to rounding. DSW: Directed Stockpile Work; RDT&E: Research, Development, Test and Evaluation; I&O: Infrastructure and Operations.

a. "Other" includes Secure Transportation Asset, Defense Nuclear Security, Information Technology and Cybersecurity, and Legacy Contractor Pensions.

Table 2. Funding for Weapons Activities, FY2021 Budget

Comparison of Reorganized Program Areas (millions of current dollars)

FY2020 Program Area	FY2020, Enacted	FY2021 Program Area	FY2020 Comparable Request	FY2021 Request	FY2021, Enacted
DSW	5,449	Stockpile Management	3,680	4,284.2	4,290.2
RDT&E	2,398	Production Modernization	1,565,5	2,457.9	2,547.9
I&O	3,151	Stockpile RDT	2,553.1	2,782.1	2813.7
Other	1,459	I&O	3,199.5	4,383.6	4,087.5
		Other	1,458.8	1,694.2	1605.6
Total	12,457	Total	12,457	15,602	15,345

Source: NNSA Budget Request, FY2021, H.R. 133, Division D-Energy and Water Development and Related Agencies, Consolidated Appropriations Act, 2021.

Notes: Details may not add to totals due to rounding.

DSW: Directed Stockpile Work; RDT&E: Research, Development, Test and Evaluation; I&O: Infrastructure and Operations: Stockpile RTE: Stockpile Research, Technology, and Engineering; Other: Secure Transportation Asset, Defense Nuclear Security, Information Technology and Cybersecurity, and Legacy Contractor Pensions.

Stockpile Management

According to NNSA's budget materials, the Stockpile Management program "maintains a safe, secure, and militarily effective nuclear weapons stockpile."[12] The activities in this program area include warhead life extension, modification and design efforts; the annual assessment process for the current active stockpile; stockpile sustainment activities; warhead dismantlement activities; and sustainment of manufacturing capabilities and capacities. According to NNSA, the

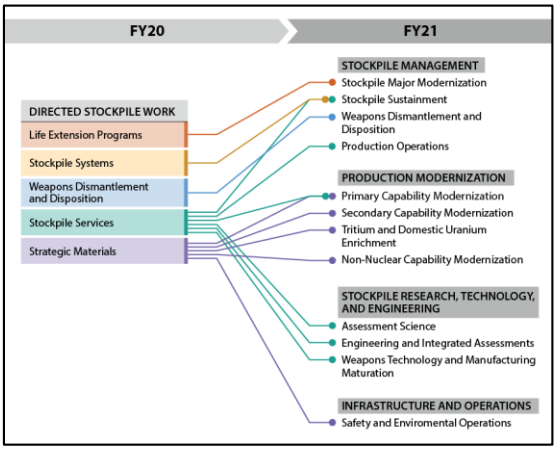
[12] Department of Energy, *Budget Request For FY2021*, Volume I, National Nuclear Security Administration, Washington, DC, February 2020, https://www.energy.gov/sites/prod/files/2020/03/f72/doe-fy2021-budget-volume-1_2.pdf.

Stockpile Management program includes four subprograms: Stockpile Major Modernization, Stockpile Sustainment, Weapons Dismantlement and Disposition, and Production Operations.

As shown in **Figure 2**, and evident in the NNSA budget documents, all of the subprograms in the Stockpile Management program were part of the Directed Stockpile Work program in previous budgets, although some Directed Stockpile Work subprograms have moved to other program areas. Specifically, according to NNSA's budget documents, parts of Stockpile Services subprogram moved into the Production Modernization program area and the Stockpile Research, Technology, and Engineering program area. Some of the Strategic Materials programs moved to Production Modernization and some moved to Infrastructure and Operations.

Congress appropriated $5,449.3 million for Directed Stockpile Work in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94). NNSA has requested $6,370.6 million, an increase of 17%, for the same subprograms in FY2021 (although not all are in the Stockpile Management Program area). Congress provided $3,680.1 million for the portions of Directed Stockpile Work that are now included in Stockpile Management and NNSA has requested $4,284.2 billion for these programs in FY2021, an increase of 16.5% over FY2020. The House provided $4,237.2 for these programs in its version of the FY2021 Energy and Water Development appropriations bill (H.R. 7613, H.Rept. 116-449). Congress appropriated $4,290.2 billion in H.R. 133, the Consolidated Appropriations Act, 2021.

Figure 2. Realignment Out of Directed Stockpile Work



Stockpile Major Modernization

The Stockpile Major Modernization subprogram funds activities that were included in the Life Extension Programs (LEP) and Major Alterations subprogram of Directed Stockpile work. According to NNSA, these activities are needed to extend the expected life of existing warheads through design, certification, manufacture, and replacement of aging components and to develop warheads in cases where current stockpile warheads cannot work with new nuclear delivery systems "without significant impacts to required military requirements."

NNSA completed an LEP for the W76 warhead for the Trident II (D-5) submarine-launched ballistic missile (SLBM) in 2019; this included a small number of low-yield W76-2 warheads. An LEP for the B61 bomb is ongoing, combining several older versions of the bomb into a single B61-12 version. NNSA is also pursuing an alteration for the W88 warhead currently deployed on Trident II (D-5) missiles and a life extension program for the W80 cruise missile warhead. The Air Force plans to deploy the new W80-4 on the new Long Range Standoff missile (LRSO) currently under development. NNSA is in the early stages of the W87-1 modification program, which is to provide a warhead for the new U.S. land-based intercontinental ballistic missiles (ICBMs) in the 2030s.

The FY2021 budget request also funds "concept assessment" for the W93 sea-based warhead, which is expected to eventually replace the W76 and W88 warheads. In the past, DOD documents had referred to this warhead as the next Navy warhead, and had not expected to request funding

for it until FY2023. A DOD official noted that because the warhead does not yet exist, this is not a life extension program, but neither NNSA nor DOD has designated this as a "new" warhead.[13] According to Admiral Richard, the Commander of USSTRATCOM, it is a new program of record.[14]

NNSA requested $2,117.4 million for life extension programs and major alterations in its FY2020 budget. In its FY2021 budget request, NNSA requested $2,666.9 million for the Stockpile Major Modernization subprogram. Congress approved this amount in Division D-Energy and Water Development and Related Agencies of the Consolidated Appropriations Act, 2021 (H.R. 133).

- NNSA requested no additional funding for the W76-1 LEP in FY2020 and FY2021. It also requested no additional funding for the W76-2 modification program—the low-yield version of the warhead—in FY2021, a reduction from the $10 million requested in FY2020. The funding for FY2020 supported program documentation and closeout activities. With the program complete, the warhead reportedly entered service in January 2020.[15]
- NNSA requested $815.7 million for the B61-12 LEP in FY2021, an increase of $23 million over the $792.6 million enacted for FY2020. Congress approved this request. The B61-12 is to combine four existing types of B61 warheads; the Air Force plans to also add a tail kit assembly that is designed to improve the accuracy of the bomb. According to NNSA's budget documents, the LEP "reuses, or replaces all of the bomb's nuclear and non-nuclear components to extend the service life of the B61 by at least 20 years, and to improve the bomb's safety, effectiveness, and security." The first production unit (FPU) was scheduled for FY2020 but was delayed due to an issue with capacitors used in six major electrical components. According to NNSA, FPU is now scheduled for FY2022, and the program is to be completed in FY2026.
- NNSA requested $256.9 million for the W88 Alternation in FY2021, a reduction of $27.2 million from the $304.2 million enacted in FY2020. Congress approved this request. The program is to upgrade the arming-fuzing-firing system on the warhead and refresh the warhead's conventional high explosives. This warhead is carried on a portion of the D-5 (Trident) submarine-launched ballistic missiles (SLBMs). NNSA expected to provide the FPU of this warhead in 2020, but according to NNSA, the delivery was delayed due to an issue with capacitors used in three major components. According to its budget documents, NNSA now estimates that it will provide the FPU in FY2021.
- NNSA requested $1,000.3 million for the W80-4 in FY2021, an increase of 11% over the 898.6 million enacted in FY2020. Congress approved this request. This is the warhead for the new long-range cruise missile. The LEP would seek to use common components from other LEPs and to improve warhead safety and

[13] Aaron Mehta, "Inside America's newly revealed nuclear ballistic missile warhead of the future," *Defense News*, February 24, 2020, https://www.defensenews.com/smr/nuclear-arsenal/2020/02/24/inside-americas-newly-revealed-nuclear-ballistic-missile-warhead-of-the-future/?utm_source=Sailthru&utm_medium=email&utm_campaign=EBB%2002.25.20&utm_term=Editorial%20-%20Early%20Bird%20Brief.

[14] Patrick Tucker and Marcus Weisgerber, "A New Nuclear Warhead? STRATCOM Chief Can't Answer Yes or No," *Defense One*, February 27, 2019, https://www.defenseone.com/politics/2020/02/new-nuclear-warhead-stratcom-chief-cant-answer-yes-or-no/163395/?utm_source=Sailthru&utm_medium=email&utm_campaign=EBB%2002.28.20&utm_term=Editorial%20-%20Early%20Bird%20Brief.

[15] Aaron Mehta, "Trump's new nuclear weapon has been deployed," *Defense News*, February 4, 2020, https://www.defensenews.com/smr/nuclear-arsenal/2020/02/04/trumps-new-nuclear-weapon-has-been-deployed/.

security. NNSA has begun to "ramp up engineering activities for development and design on the W80-4," and the significant increases in the budget request for FY2021 reflect an increase in the scope of work on the program. The FPU is scheduled for FY2025.

- NNSA requested $541 million W87-1 warhead modification program, a nearly fivefold increase over the $112 million enacted for the W87-1. Congress approved this request. This increase reflects a "ramp-up" of activities across all program areas. The Air Force plans to deploy the W87-1 on the new U.S. land-based intercontinental ballistic missile (ICBM), the Ground-Based Strategic Deterrent (GBSD). NNSA has indicated that the FPU for the W87-1 is currently planned for FY2030. However, the FY2021 budget documents also note that the W87-0 warhead, which is currently deployed on U.S. ICBMs, will also be "qualified and deployed onto the GBSD." This would provide the Air Force with an alternative warhead if the W87-1 FPU is delayed.
- NNSA requested $53 million in FY2021 to begin Phase 1 "concept assessment and refinement" activities for the W93 warhead. The House declined to appropriate this funding in its version of the FY2021 Energy and Water Development appropriations bill (H.R. 7613, H.Rept. 116-449). It expressed a number of concerns, noting that NNSA had "provided limited details" on why it needed to start this assessment in 2021 and that the joint Department of Energy-Department of Defense nuclear weapons lifecycle process might be "out of date and does not include current best practices." Congress, however, approved the request in Division D of the Consolidated Appropriations Act, 2021 (H.R. 133). It also mandated that NNSA and DOD provide Congress with plan to study and conduct Phase 1 of the weapon's development process, and that they brief Congress before moving to Phase 2.

In May 2019, NNSA indicated that the delivery of the first production units for both the B61-12 and the W88 Alt were likely to slip after it identified defects in the electrical capacitors used in the modified warheads. NNSA's Kansas City National Security Campus, which acquires the non-nuclear parts of nuclear weapons, determined that the capacitors might not remain reliable for the 30-year life of the modified warheads. As a result, NNSA plans to replace the capacitors that cost about $5 per unit with $75 units built to a higher standard. This is likely to add about $120-$150 million to the cost of the W88-Alt LEP and $600 million to $700 million to the cost of the B61-12 LEP.[16]

As noted above, the W87-1 warhead will replace the W78 warhead on U.S. ICBMs, beginning with the deployment of the GBSD in the 2030s.[17] The W78, which is the oldest warhead in the U.S. stockpile, dating from 1979, was originally supposed to be replaced by a new warhead, known as the IW1, which would have been an interoperable warhead that could be delivered by ICBMs (in place of the W78 warhead) and SLBMs (in place of the W88 warheads). The FY2016 budget request suspended work on the IW1, and the FY2017 and FY2018 budgets did not request

[16] Dan Leone, "Balky Capacitors Could Delay Two NNSA Nuke Refurb Programs," *Nuclear Security and Deterrence Monitor*, May 10, 2019. https://www.exchangemonitor.com/balky-capacitors-delay-two-nnsa-nuke-refurb-programs/. See, also, Aaron Mehta, "How a $5 part used to modernize nuclear warheads could cost $850 million to fix," *Defense News*, September 25, 2019. https://www.defensenews.com/smr/nuclear-arsenal/2019/09/25/nuclear-warhead-programs-need-850m-fix-heres-how-the-government-plans-to-cover-it/?utm_source=Sailthru&utm_medium=email&utm_campaign=EBB%2009.26.19&utm_term=Editorial%20-%20Early%20Bird%20Brief.

[17] U.S. Department of Energy, National Nuclear Security Administration, *W78 Replacement Program (W87-1): Cost Estimates and Use of Insensitive High Explosives*, Report to Congress, Washington, DC, December 2018, https://nukewatch.org/newsite/wp-content/uploads/2019/02/W78-Replacement-Program-Cost-Estimates-IHE-1.pdf.

any funding for it. The FY2019 budget requested $53 million to resume research and development activities on the IW1. Congress enacted this amount, but the conference report (H.Rept. 115-929) requested a study on the rationale for and alternatives to the plan to use an interoperable warhead as a part of the W78 life extension program. During 2019, NNSA dropped the IW1 designator and instead, pursued a life extension program for just the W78 ICBM warhead. It then designated this program as the W87-1, to reflect the fact that it has a similar primary design to the existing W87 ICBM warhead for the IW1.

Congress provided the requested amount of $112 million for the W87-1 in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94). However, it indicated that NNSA could not obligate more than 75% of the funding until it provided the House and Senate Appropriations Committees with a report that included a list of all major design decisions that had been made for the warhead and an explanation of the cost trade-offs for each decision, and that identified major risks and contingency plans to address each risk.

Stockpile Sustainment

According to NNSA, Stockpile Sustainment "directly executes sustainment activities for the total (active and inactive) stockpile for the B61, W76, W78, W80, B83, W87, and W88 weapons." This program area is essentially the same as the Stockpile Services program area in the FY2020 budget, which provided for routine maintenance, replacement of limited-life components, surveillance, and assessment of fielded systems for all weapons types in the active stockpile. It also includes the Multi-Weapon Systems subprogram, which had been funded under the Manufacturing, Technology, and Production subprogram in the Stockpile Services subprogram of Directed Stockpile Work in the FY2020 budget.

Congress enacted $635.8 million for Stockpile Systems in FY2020. It also enacted $305 million for Manufacturing, Technology, and Production. Within the FY2020 request, NNSA sought $51.5 million to sustain the B83 gravity bomb, which the Obama Administration had planned to retire in the early 2020s. The Trump Administration reversed that decision in the 2018 Nuclear Posture Review and added funding for FY2020 to support B83 sustainment activities. The FY2020 NNSA budget also added funding to support a study of the proposed new Sea-Launched Cruise Missile (SLCM). The House Energy and Water Appropriations Subcommittee (H.R. 2960, H.Rept. 116-83), eliminated the requested funding for the SLCM study and reduced the funding for B83 sustainment to $22.4 million, appearing to signal its opposition to both the development of a new SLCM and the retention of the B83 bomb beyond its intended retirement.

In the Further Consolidated Appropriations Act, 2020 (P.L. 116-94), Congress approved the funding request for the W80 warhead, which would support the existing warhead and fund the SLCM study, but divided the funding into two categories: $80.2 million for W80 Stockpile Systems and $5.6 million for assessments and studies to support the ongoing analysis of alternatives for the new SLCM. It also directed NNSA to request separate funding for the SLCM study in future budget requests "to improve oversight and visibility of these activities." Congress also funded the Administration's request for B83 sustainment, but directed NNSA to submit a report on "the current status and future plans for the B83 system." This report should identify options "for meeting military requirements through retirement, retention, and extension, including the complete replacement of the system."

NNSA requested $998.3 million for Stockpile Sustainment in FY2021, an increase of 5% over the $962.7 million that the programs in this area received in FY2020. Congress provided this amount in Division D-Energy and Water Development and Related Agencies of the Consolidated Appropriations Act, 2021 (H.R. 133) Within this total, the budget request shows increases in

sustainment funding for the B61 gravity bomb and the W76, W78, and W87 warheads, but a decrease in funding for the B83 bomb. NNSA noted that the FY2021 budget request does not include any funding for assessments and studies to support the ongoing analysis of alternatives for the new SLCM because "DOD requirements remain undefined."

The budget documents note that, with respect to the B83, NNSA plans to continue to pursue the surveillance and assessment activities needed to support the requirement in the 2018 Nuclear Posture Review, but that it anticipates using some prior years funding for this program. In Division D-Energy and Water Development and Related Agencies of the Consolidated Appropriations Act, 2021 (H.R. 133), Congress provided $30.8 million for B83 sustainment and directed NNSA to provide Congress with "periodic and timely briefings concerning the status of sustainment efforts." The explanatory note in Division D noted that Congress remained concerned about the feasibility of maintaining the bomb with reduced funding and the possibility that the bomb might need eventual modifications for its warhead.

Weapons Dismantlement and Disposition (WDD)

According to a fact sheet released by the State Department in 2017, the U.S. nuclear stockpile peaked at 31,255 warheads in 1967, stood at 19,008 warheads in 1991, and declined to 4,571 warheads by 2015.[18] It had declined further, to 4,014 warheads by 2016 and 3,822 by 2017. The WDD subprogram includes funding for the interim storage of warheads awaiting dismantlement, funding for actual dismantlement, and funding for the disposition of warhead components and materials. NNSA requested $68.9 million for WDD for FY2017, an increase over the appropriated level of $52 million in FY2016. According to NNSA, this increase was designed to support President Obama's commitment, pledged at the 2015 Nuclear Nonproliferation Treaty Review Conference, to accelerate dismantlement of retired U.S. nuclear warheads by 20%. The Senate Energy and Water Development Appropriations Subcommittee approved this request and noted in its report (S.Rept. 114-236) that it supported the accelerated dismantlement plan "as a way of preparing its workforce for necessary stockpile production work beginning later this decade." The House subcommittee, however, objected to the accelerated dismantlement plan and reduced total funding for directed stockpile work. The final version of the Consolidated Appropriations Act for FY2017 (P.L. 115-31) allocated $56 million to weapons dismantlement and disposition.

NNSA requested $56 million for weapons dismantlement and disposition in FY2018 and FY2019; Congress approved this amount in both years. NNSA's budget documents note that funding for this program was capped at $56 million at the direction of the FY2017 and FY2018 National Defense Authorization Acts. NNSA also noted that dismantlement activities serve as "a significant supplier of material for future nuclear weapons production and Naval Reactors." Unlike in previous years, however, the FY2019 budget documents do not reiterate the goal, supported by previous budgets, of dismantling weapons retired prior to FY2009 by FY2022.

NNSA requested $47 million for weapons dismantlement and disposition in FY2020. NNSA's budget request noted that the decline in funding requested for this program area "results from a reduction in legacy component disposition … consistent with material and component needs for the stockpile and external customers." Hence, as was the case in the FY2019 budget request, while NNSA still sees the WDD program as a supplier of materials to the U.S. weapons stockpile, it no longer sees it as a component of U.S. nonproliferation policy. Congress increased funding

[18] U.S. Department of Defense, Stockpile Numbers, End of Fiscal Years 1962-2016. May 2016, http://open.defense.gov/Portals/23/Documents/frddwg/2015_Tables_UNCLASS.pdf.

for this program in FY2020 in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94), in which Congress approved $56 million for WDD.

NNSA requested $50 million for WDD in FY2021. As was the case in FY2020, NNSA noted that the decline in funding for requested for this program area results from a "reduction of legacy component inventories." The House, in its version of the FY2021 Energy and Water Development appropriations bill (H.R. 7613, H.Rept. 116-449), added $6 million to the WDD account; Congress accepted this position and appropriated $56 million for WDD in H.R. 133, the Consolidated Appropriations Act, 2021.

Production Operations

According to NNSA's budget documents, the Productions Operations program area includes the Production Support subprogram that had been a part of the Stockpile Services program area in the FY2020 budget structure. Other portions of Stockpile Services have been moved to other areas of the Weapons Activities budget. As noted above, NNSA renamed the Manufacturing, Technology, and Production subprogram as the Multi-Weapon Systems subprogram and moved it to the Stockpile Sustainment program area. Other parts of Stockpile Services have moved to the Production Modernization program area and the Stockpile Research, Technology, and Engineering program area. These program areas are discussed below.

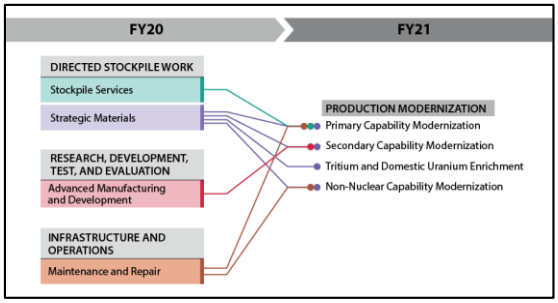
Production Operations "provides engineering and manufacturing labor, quality assurance, and programmatic equipment support for the manufacturing base that enables the individual site capability and capacity to sustain NNSA's nuclear security enterprise's production mission." The activities in the production mission include weapon assembly, weapon disassembly, component production, surveillance, and weapon safety and reliability testing. NNSA also notes that Production Operations coordinates closely with Advanced Manufacturing Development program, which is funded through the Stockpile Research, Technology, and Engineering program area.

NNSA requested $568.9 million for Production Operations in FY2021, an increase of $24.9 million over the $544 million enacted for Production Support in FY2020. According to NNSA, this increase supports continued growth needed to support the LEP workload. Congress appropriated this amount in H.R. 133, the Consolidated Appropriations Act, 2021.

Production Modernization

According to NNSA's budget documents for FY2021, the Production Modernization program area "focuses on the production capabilities of nuclear weapons critical to weapon performance, including [plutonium] primaries, [uranium] secondaries, radiation cases, and non-nuclear components." As **Figure 3** shows, and as is evident in NNSA's budget request, NNSA funded most of these subprograms through the Strategic Materials portion of Directed Stockpile Work in the FY2020 budget. The new program also brings in subprograms from Stockpile Services and from other FY2020 program areas, such as portions of Advanced Manufacturing Development

Figure 3. Realignment into Production Modernization



from the Research, Development, Test and Evaluation program area, and portions of Capabilities Based Investments from the Infrastructure and Operations Program Area.

NNSA requested, and Congress approved, $1,501 million for Strategic Materials in FY2020. According to NNSA's FY2021 budget documents, with additions from other program areas, the subprograms now included in Production Modernization were funded at $1,565.5 million in FY2020. NNSA has requested $2,457.9 million for Production Modernization in FY2021, an increase of 56% over FY2020. The House, in its version of the FY2021 Energy and Water Development appropriations bill (H.R. 7613, H.Rept. 116-449), approved $1,858.7 million and did not adopt all the program changes identified and the FY2021 budget request. However, in H.R. 133, the Consolidated Appropriations Act for 2021, Congress maintained the program changes and appropriated $2,547.9 million for Production Modernization.

NNSA has divided the Production Modernization program area into four subprograms: Primary Capability Modernization, Secondary Capability Modernization, Non-nuclear Capability Modernization, and Tritium and Domestic Uranium Enrichment. As noted below, the budget request seeks increases in funding for each of the subprograms, although nearly 70% of the added funding supports Primary Capability Modernization.

Primary Capability Modernization

According to NNSA's budget documents, the Primary Capability Modernization program "consolidates management of nuclear material processing capabilities … needed for the production of primaries." Primaries are the plutonium pits and high explosives that serve as the core of nuclear weapons. In FY2020, Congress approved $797.8 million for the plutonium modernization programs that are now a part of this program area; NNSA has requested $1,369.3 million for FY2021. Congress approved $13.8 million for high explosives and energetics in FY2020; NNSA has requested $67.4 million in FY2021.

NNSA began to ramp up funding for plutonium modernization in the FY2020 budget request, when it sought $712 million for plutonium sustainment, which represented a 97% increase over the $361.3 million enacted for plutonium sustainment in FY2019. The FY2020 budget documents noted that NNSA restructured this program to support the May 2018 decision to pursue a new approach for plutonium pit production to meet the requirement of producing a minimum of 80 pits per year by 2030. Instead of focusing solely on building capacity at Los Alamos National Laboratory, NNSA decided to "repurpose the Mixed Oxide (MOX) Fuel Fabrication Facility at the Savannah River Site to produce at least 50 pits per year" and to continue work that would allow Los Alamos to produce "no fewer than 30 pits per year."[19] Consequently, NNSA requested $420 million to support design activities at Savannah River and begin the modifications needed to produce 50 pits per year at the repurposed facility by 2030.

The Plutonium Sustainment subprogram from the FY2020 budget divides into four subprograms for FY2021: Los Alamos Plutonium Modernization ($593.5 million requested), Plutonium Pit Production Project at Los Alamos ($226 million requested), Savannah River Plutonium Modernization ($200 million requested), and Savannah River Plutonium Processing ($241.9 million requested). The two program areas at Los Alamos fund activities needed to recapitalize buildings and capacity to meet pit production requirements at Los Alamos. The programs at Savannah River support efforts to plan for operations at the new pit facility, to work on its design,

[19] U.S. Department of Energy, National Nuclear Security Administration, *Plutonium Pit Production*, Fact Sheet, Washington, DC, April 2019, https://www.energy.gov/sites/prod/files/2019/05/f62/2019-05-13-FACTSHEET-plutonium-pits.pdf.

its site and facility preparation, and to begin long lead procurement. Congress approved each of these requests in Division D-Energy and Water Development and Related Agencies of the Consolidated Appropriations Act, 2021.

In Division D, Congress reiterated concerns with NNSA's pit production plans. It mandated that NNSA provide a plan outlining an integrated master schedule for "all pit production-related project and program activities" going forward. It also directed NNSA to develop "a comprehensive, integrated ten-year research program for pit and plutonium aging that represents a consensus program among the national laboratories and federal sponsors."

NNSA requested, and Congress appropriated, $90.8 million in the Primary Capability Modernization program area for Enterprise Plutonium Support, which funds activities that support pit production across the Nuclear Security Enterprise. Congress approved $79.2 million for these programs in FY2020. NNSA has also requested, and Congress appropriated, $67.4 million for High Explosives and Energetics in FY2021. This program area, which in FY2020 was funded through Stockpile Services in Directed Stockpile Work and Capabilities Based Investments in Infrastructure and Operations, focuses on modernizing production facilities and qualifying explosive and propellant materials used in nuclear warhead primaries.

Secondary Capability Modernization

NNSA requested $457 million for Secondary Capability Modernization in FY2021, an increase of 56% over the $293.5 million allocated to the same programs in FY2020. NNSA funded most programs in this area through the Strategic Materials portion of Directed Stockpile Work in FY2020, although $64 million was a part of the Advanced Manufacturing program area in Research, Development, Test, and Evaluation. Congress approved this request in H.R. 133, the Consolidated Appropriations Act, 2021.

According to NNSA, this program area "is responsible for restoring and increasing manufacturing capabilities for the secondary stage of nuclear weapons." It includes a request for $306.7 million for efforts to modernize enriched uranium operations at the Y-12 facility, an increase of 57% over the $194.2 million funded in FY2020. NNSA has also requested $110 million for a new depleted uranium modernization program that is to restart capabilities that lapsed in the early 2000s. Finally, NNSA has requested $39.4 million for lithium modernization in FY2021, an increase of 10% over the FY2020 funding. This subprogram modernizes facilities at the Y-12 plant and process lithium to support defense programs.

Non-nuclear Capability Modernization

NNSA requested $107.1 million for Non-nuclear Capability Modernization in FY2021. This is a sevenfold increase over the $14 million allocated to the programs in this area in FY2020, when they were funded through the Strategic Materials subprogram of Directed Stockpile Work and the Capabilities Based Investments subprogram of Infrastructure and Operations. According to NNSA, this program area "provides funding to modernize production of non-nuclear components for multiple weapon systems." The requested increase in FY2021 is to support production of non-nuclear components at the Kansas City National Security Complex. Congress approved this request.

Tritium and Domestic Uranium Enrichment

NNSA requested $457.1 million for Tritium and Domestic Uranium Enrichment in FY2021, an increase of $10 million over the $455.6 million enacted in FY2020. NNSA funded this program

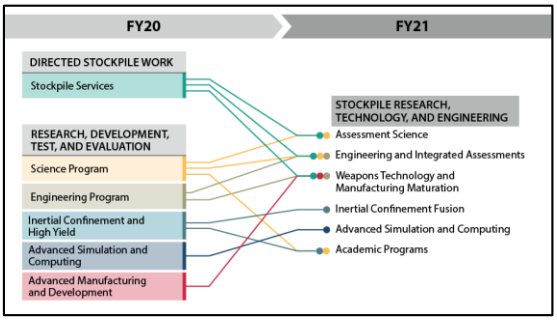
area through the Strategic Materials subprogram of Directed Stockpile Work in FY2020. The Tritium Modernization portion of this program ($312.1 million requested) funds activities needed to produce, recover, and recycle the tritium gas that used in U.S. nuclear weapons.[20] The Domestic Enriched Uranium Program ($145.3 million requested) is designed to ensure a reliable supply of enriched uranium to support U.S. national security and nonproliferation needs. According to NNSA, "its goal is to supply current enriched uranium needs and re-establish a domestic uranium enrichment capability." Congress appropriated $547.1 million in this program area, adding $90 million for a Uranium Downblend program.

Stockpile Research, Technology, and Engineering (SRT&E)

According to NNSA's budget request, Stockpile Research, Technology, and Engineering includes six subprograms that provide "the knowledge and expertise needed to maintain confidence in the nuclear stockpile without additional nuclear explosive testing." This program area "provides the foundation for science-based stockpile decisions, tools, and components; focuses on the most pressing investments nuclear security enterprise needs to meet DOD warhead needs and schedules; and enables assessment and certification capabilities used throughout the Nuclear Security Enterprise." It funds not only the science and engineering programs, but also large experimental facilities, like the Enhanced Capabilities for Subcritical Experiments (ECSE) program and the Nevada National Security Site (NNSS) and NNSA's first Exascale system at Livermore Laboratory.

As **Figure 4** shows, and as is evident in the NNSA budget request, the program areas funded through SRT&E FY2021 are similar to those funded though the Research, Development, Test and Evaluation (RDT&E) program in the FY2020 budget, with some program areas added from the Stockpile Services portion of Directed Stockpile Work. Congress appropriated $2,397.5 million for RDT&E in FY2020. According to NNSA's budget documents, Congress allocated $2553.1 million in FY2020 for the programs now included in SRT&E. NNSA requested $2,782.1 million for SRT&E in FY2021. The House, in its version of the FY2021 Energy and Water Development appropriations bill (H.R. 7613, H.Rept. 116-449), recommended $2,660.3 million for SRT&E. Congress appropriated $2,813.7 million in H.R. 133, the Consolidated Appropriations Act, 2021.

Figure 4. Realignment into SRT&E



Specific programs under SRT&E include the following.

Assessment Science

Assessment Science replaces the Science Program from prior years' budgets. According to NNSA's budget documents, the Assessment Science program provides "the scientific underpinnings required to conduct annual assessments of weapon performance and certification

[20] Tritium is a radioactive form of hydrogen needed to boost the yield of nuclear weapons. Because it has a half-life of 12.4 years and degrades at a rate of 5.5% per year, the tritium in nuclear weapons must be replenished regularly.

of LEPs" along with the "information required to understand the impacts of surveillance findings to assure that the nuclear stockpile continues to remain safe, secure, and effective." Specifically, it performs experiments to obtain the materials and nuclear data required to validate and understand the physics of nuclear weapons performance and pursues activities that develop, exercise, and maintain the expertise of NNSA's nuclear weapon design, engineering, and assessment community.

NNSA requested $773.1 million for the Assessment Science program in FY2021, an increase of 30% over the $594.8 million allocated to comparable programs in FY2020. This includes $152.8 million for Hydrodynamic and Subcritical Experiment Execution Support, an increase of 31% over the FY2020 funding of $116.2 million. This program area, which NNSA funded through Stockpile Services in FY2020, "maintains a robust testing capability to supply critical data to weapon physicists and design engineers." In addition, NNSA has requested a significant increase in funding for Enhanced Capabilities for Subcritical Experiments (from $145.1 million in FY2020 to $215.6 million in FY2021). According to NNSA's budget documents, this funding increase addresses cost growth for planned installation of the equipment needed to support the W80-4 and W87-1 program certification requirements. Congress appropriated $769.4 million for this program area in FY2021.

Engineering and Integrated Assessments

Engineering and Integrated Assessments replaces the Engineering Program from prior years' budgets. It also includes some subprograms that had been funded through the Science Program and Stockpile Services in FY2020. According to NNSA, this program strengthens "the science, technology, and engineering base by maturing advanced technologies to improve future weapon systems" and provides "tools for qualifying weapon components and certifying weapons without nuclear explosive testing." It includes funding for the Stockpile Responsiveness program, which NNSA had added to its budget request in FY2018, in response to congressional direction in the FY2016 National Defense Authorization Act (NDAA).

Congress appropriated $263.4 million for the Engineering Program in FY2020. According to NNSA's budget documents, the programs included in Engineering and Integrated Assessments received $325.1 million in FY2020. NNSA requested, and Congress appropriated, $337.4 million for this program area in FY2021.

Inertial Confinement Fusion Ignition and High Yield Program

This program develops the tools needed to create extremely high temperatures and pressures in the laboratory—approaching those of a nuclear explosion—to support weapons-related research and to attract scientific talent to the Stockpile Stewardship Program. The centerpiece of this campaign is the National Ignition Facility (NIF), the world's largest laser, located at Lawrence Livermore National Laboratory. NIF is intended to produce "ignition," the point at which a nuclear fusion reaction generates more energy than is used by the lasers to create the reaction. While achieving ignition has been delayed, NIF has nonetheless proven to be of value to stockpile stewardship at energy levels that do not reach ignition. NIF was controversial in Congress for many years, but controversy waned as the program progressed. NIF was dedicated in May 2009.[21] The program also supports the Z Facility at the Sandia National Laboratories (SNL), and the

[21] Lawrence Livermore National Laboratory, "Dedication of World's Largest Laser Marks the Dawn of a New Era," press release, May 29, 2009, https://publicaffairs.llnl.gov/news/news_releases/2009/NR-09-05-05.html.

Omega Laser Facility (Omega) at the University of Rochester's Laboratory for Laser Energetics (LLE).

NNSA requested $480.6 million for this program area in its FY2020 budget, a reduction of nearly 12% from the $544.9 million enacted in FY2019. NNSA's budget documents noted that this reduction reflected a shift in funding to "higher priority NNSA efforts." Congress appropriated $565 million for this program area, recommending $344 million for the NIF, $66.9 million for the Z Facility and not less than $80 million for the OMEGA Laser Facility.

NNSA requested $554.7 million for this program area in FY2021. Within this total, it requested $339.3 million for the NIF, $65.6 million for the Z facility, and $75 million for the OMEGA Laser Facility. Congress appropriated $575 million. Within this total, it allocated $349 million for NIF, $67 million for the Z facility, and $82 million for the OMEGA Laser Facility.

Advanced Simulation and Computing (ASC) Program

The ASC program develops computation-based models of nuclear weapons that integrate data from other campaigns, past test data, and laboratory experiments, to create what NNSA calls "the computational surrogate for nuclear testing to determine weapon behavior." NNSA notes that "modeling the extraordinary complexity of nuclear weapons systems is essential to maintaining confidence in the performance of our aging stockpile without underground testing." This program also supports nonproliferation, emergency response, and nuclear forensics.

NNSA requested and Congress appropriated $839.8 million for the ASC program in FY2020. In its FY2021 budget, NNSA moved the Construction subprogram in ASC to the Programmatic Construction subprogram within Infrastructure and Operations, leaving $767.8 million in comparable funding for FY2020 ASC programs. NNSA requested, and Congress appropriated, $732 million for the ASC Program in FY2021.

Weapon Technology and Manufacturing Maturation

According to NNSA, the Weapon Technology and Manufacturing Maturation program will develop "agile, affordable, assured, and responsive technologies and capabilities for nuclear stockpile sustainment and modernization." As a part of the FY2021 budget realignment, this program area includes subprograms that had been a part of the Engineering Program, the Advanced Manufacturing Development program, and the Stockpile Services program in FY2020.[22]

NNSA requested, and Congress appropriated, $298 million for this program area in FY2021. This is a 34% increase over the $222.3 million allocated to comparable programs in FY2020. According to NNSA budget documents, $111.9 million will support the Advanced Manufacturing subprogram and $131.7 million will support Weapon Technology Development subprogram.

Infrastructure and Operations (I&O)

According to NNSA's budget documents, the Infrastructure and Operations program area "maintains, operates, and modernizes the NNSA infrastructure in a safe, secure, and cost-effective manner to support program results while maximizing return on investment and reducing enterprise risk." In FY2021 the program is to continue to "improve the condition and extend the

[22] The third program in Advanced Manufacturing Development, the Process Technology Development subprogram, moved to the Production Modernization program area.

design life" of existing buildings while also supporting construction of new facilities. There is widespread agreement that NNSA's infrastructure is in need of significant upgrades, with some facilities dating from early in the nuclear age.

NNSA requested $3,208.4 million for this program area in its FY2020 budget; Congress provided $3,151.4 million. NNSA has requested $4,383.6 million for FY2021, an increase of 37% over the $3,199.5 million allocated to comparable programs in FY2020. NNSA's budget documents indicate that this increase in funding "represents the acceleration of a long-term effort to modernize NNSA infrastructure." The House, in its version of the FY2021 Energy and Water Development appropriations bill (H.R. 7613, H.Rept. 116-449), recommended $3,351.9 million for I&O, with reductions coming from maintenance, recapitalization, and construction portions of the budget. Congress appropriated $4,087.5 million in H.R. 133, the Consolidated Appropriations Act, 2021.

Specific programs under I&O include the following:

Operations of Facilities

The Operations of Facilities program includes the funding needed to "operate NNSA facilities in a safe and secure manner." It contains, essentially, the operating budgets for each of the eight NNSA sites, funding such areas as "water and electrical utilities; safety systems; lease agreements; and activities associated with Federal, state, and local environmental, and worker safety and health regulations." NNSA requested $905 million for this program area in its FY2020 budget; Congress approved $900 million in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94).

NNSA requested, and Congress appropriated, $1,014 million for this program area in FY2021. According to its budget documents "the increase … supports pit production at LANL and additional leased space at Kansas City to meet Life Extension Program (LEP) schedules."

Safety and Environmental Operations

According to NNSA's budget documents, the Safety and Environmental Operations program supports "safe, efficient operation of the nuclear security enterprise through the provision of safety data, nuclear material packaging, environmental monitoring, and nuclear material tracking." NNSA requested $119 million for FY2020; Congress provided $110 million in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94). The comparable amount for FY2020 is $130.9 million, as this program area now includes the Nuclear Materials Integration subprogram from Strategic Materials Sustainment in Directed Stockpile Work. NNSA requested, and Congress appropriated, $165.4 million for FY2021, with a significant portion of the increase supporting the Long Term Stewardship program that treats contaminated ground water at a number of facilities.

Maintenance and Repair of Facilities

The Maintenance and Repair of Facilities program funds the "recurring day-to-day work required to sustain and preserve NNSA facilities and equipment in a condition suitable for their designated purpose." This is the program area that addresses the backlog in deferred maintenance at NNSA facilities.

NNSA requested and Congress provided $456 million for this program area in its FY2020 budget. This request was lower than the $515 million that Congress had appropriated in FY2019. NNSA

noted that overall funding for maintenance "has grown significantly but appropriately over the last several budget cycles" and that the decrease in the FY2020 request "allows the sites to absorb the significant increases in FY2018 and FY2019 funding by increasing staffing levels to address the long-standing deficiency of a robust maintenance program."

NNSA requested $792 million for Maintenance and Repair of Facilities in its FY2021 budget. According to NNSA, this "elevates funding above the FY2019 level to address infrastructure risk and reduce deferred maintenance" at sites across the Nuclear Security Enterprise. Congress appropriated $667 million for this program area in FY2021.

Recapitalization

According to NNSA, the Recapitalization program is key to arresting the declining state of NNSA infrastructure. The program, which funds three subprograms—Infrastructure and Safety, Capabilities-Based Investments, and Planning for Programmatic Construction—is intended to address obsolete support and safety systems, revitalize aging facilities, and improve the reliability, efficiency, and capability of core infrastructure.

NNSA requested and Congress appropriated $583 million for Recapitalization in its FY2020 budget. With the realignment of NNSA's budget, the comparable amount for FY2020 would be $560.1 million. NNSA requested $903.9 million for this program area in FY2021. Within this total, $84.7 million was allocated to the Planning for Programmatic Construction subprogram, which is new to the Recapitalization budget in FY2021. According to NNSA's budget documents, this subprogram "consolidates the early planning activities … for a portfolio of project proposals that are under evaluation by the NNSA." The budget request also includes $670 million for Infrastructure and Safety, an increase of nearly 50% over the FY2020 appropriation of $447.7 million. According to NNSA's budget documents, this increase supports, among other things, the goal of producing 30 pits per year at Los Alamos.

Congress appropriated $732.8 million for Recapitalization in Division D of the Consolidated Appropriations Act, 2021 (H.R. 133). It provided $573.7 for Infrastructure and Safety and only $10 million for Planning and Programmatic Construction.

Construction

According to NNSA's budget documents, the Construction program focuses on two primary objectives: identifying construction projects that are needed to support the objectives of the weapons program and developing and executing these projects within approved cost and schedule baselines. NNSA is currently planning or managing 20 projects through this program area. This includes two controversial and expensive projects—the Uranium Processing Facility (UPF) at the Y-12 National Security Complex (TN) and the Chemistry and Metallurgy Research Replacement (CMRR) Project, which deals with plutonium, at Los Alamos National Laboratory (NM).

NNSA requested $1,145.4 million for Construction in its FY2020 budget request. The budget documents noted that much of the increase over the FY2019-enacted level of $1033.8 million "primarily reflects funding for construction of the UPF at Y-12, the High Explosive Science & Engineering Facility at Pantex, and the U1a Complex Enhancements Project" at National Nuclear Security Site (NNSS) in Nevada. Specifically, NNSA requested $745 million for UPF and $168 million for CMRR. The reduction in funding for CMRR reflected a more limited scope for the project. Congress provided $1,102.4 million in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94). It approved the requested funding of $745 million for UPF and reduced the

funding for the High Explosive Science & Engineering Facility at Pantex from $123 million to $80 million.

NNSA requested, and Congress appropriated, $1,508.3 million for Construction in its FY2021 budget request, a 30% increase over the $1,152.4 million approved for comparable programs in FY2020. According to NNSA's budget documents, the increase in funding supports programs that include the resumption of funding for the Transuranic Liquid Waste Facility and the demolition of existing structures at the Lithium Processing Facility at Y-12. The FY2021 budget request includes $750 million for UPF at Y-12 and $169 million for CMRR. It also includes $43 million for the High Explosive Science and Engineering Facility at Pantex.

Other Programs

Weapons Activities has several smaller programs, including the following.

Secure Transportation Asset

This program provides for safe and secure transport of nuclear weapons, components, and materials. It includes special vehicles for this purpose, communications and other supporting infrastructure, and threat response. NNSA has sought significant increases in funding in this program in recent years, although Congress did not approve the requested amounts. For example, NNSA sought $282.7 million in FY2017, an increase of 19% over the FY2016-enacted level to allow it to increase the number of federal agents working on the program; maintain and replace critical vehicles; and resume candidate training classes that had been cancelled for several years due to budget shortfalls. Congress provided $249 million for FY2017. In FY2018, NNSA requested $325 million, noting that it needed the significant increase to develop specialized vehicles, maintain a force of well-trained agents, and sustain a robust communication system. Congress approved $291.1 million in FY2018. In FY2019, NNSA reversed course and requested $278.6 million for this program area, a reduction of 14% from the FY2018 request; Congress approved this request. In its budget documents, NNSA indicated that this funding level would allow it to continue to support improvements in its specialized vehicles and staffing needs. NNSA requested $317.2 million for this program area in the FY2020 budget, an increase of $38.5 million over the amount enacted in FY2019. Congress appropriated $292.7 million in FY2020. NNSA indicated that this funding would support "critical workforce capabilities and asset modernization initiatives" and restore Federal Agent strength levels required to meet the STA mission capacity.

NNSA requested $390 million for this program area in its FY2021 budget request, an increase of 33% over the amount enacted in FY2020. A significant portion of this funding would support the Operations and Equipment subprogram, with an increase of $81.4 million over the $185 million enacted in FY2020. NNSA indicated that the increase in funding for FY2020 will support its staffing requirements, the development and final testing of new specialized vehicles, and the procurement of replacement aircraft. Congress appropriated $348.7 million, reducing the request for the Operations and Equipment subprogram to $225 million.

Defense Nuclear Security

According to NNSA's budget documents, this program "provides protection for NNSA personnel, facilities, and nuclear weapons and materials from a full spectrum of threats, ranging from local security incidents to terrorism." It provides operations, maintenance, and construction funds for protective forces, physical security systems, and personnel security. NNSA requested $778.2

million for this program area in FY2020; Congress appropriated $775 million in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94). According to NNSA's budget request, this "includes funding to fill positions in key security program areas at the sites, including protective forces, physical security systems, information security, technical security, personnel security, nuclear material control and accountability, and security program operations and planning." NNSA requested $826.9 million for this program area in FY2021. According to NNSA, the increase in nearly 7% over the FY2020 budget is "based on additional security requirements associated with growth across the NNSA Nuclear Security Enterprise, including Plutonium Pit Production efforts." Congress appropriated $789 million.

Information Technology and Cybersecurity

According to NNSA's budget documents, this program provides funding "to develop information technology and cybersecurity solutions, including continuous monitoring, and security technologies to help meet increased proliferation-resistance and security." It also funds programs to consolidate NNSA's IT services. NNSA requested $309 million for this program area in the FY2020 budget; Congress appropriated $300 million in the Further Consolidated Appropriations Act, 2020 (P.L. 116-94). The budget documents indicated that the funding for FY2020 would allow for the continued "integration and coordination of cybersecurity and information technology support activities and functions throughout the NNSA nuclear security enterprise."

NNSA requested $375.5 million for this program area in FY2021, an increase of 25% over the amount enacted in FY2020. Within this increase, NNSA has allocated $46.4 million to support cybersecurity modernization efforts at the NNSA sites and $29 million to Information Technology modernization. Congress appropriated $366.2 million.

Legacy Contractor Pensions

For many decades, the University of California (UC) operated Los Alamos and Lawrence Livermore National Laboratories. Laboratory employees, as UC employees, could participate in the UC pension plan. When the contracts for the labs' operations were taken over by private corporations, the contracts between DOE and the new laboratory operators included provisions that provided pensions to employees who had worked under the UC contract that mirrored the UC pension benefits. These pensions were larger than those provided to employees hired after the contracts were granted to private employers. To make up the difference, NNSA has paid into the pension plan for those current employees who formerly worked under the UC system. NNSA requested, and Congress approved, $91 million for legacy contractor pensions in FY2020, a reduction of $71.1 million for the amount enacted in FY2019. According to NNSA, this did not represent a change in the program but was based on the needs of the program and the funded status of the plan. NNSA requested, and Congress appropriated, $101.7 million for this program area in FY2021.

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