Weapons Activities
Proposed Appropriation Language

For Department of Energy expenses, including the purchase, construction, and acquisition of plant and capital equipment and other incidental expenses necessary for atomic energy defense weapons activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, and the purchase of not to exceed *one ambulance* for replacement only, [$*15,345,000*,000] *$16,486,298,000* to remain available until expended: Provided, That of such amount, [$*123,684*,000] *$130,070,000* shall be available until September 30, [2022] *2024*, for program direction.

Explanation of Change

The FY 2023 Budget Request provides a 7.4% increase from the FY 2021 Enacted Level to support ongoing warhead acquisition programs: B61-12, W88 Alt 370, W80-4, W87-1, and the W93; development and qualification for the W76-1/2 Mk4B Shape Stable Nose Tip retrofit and legacy Stockpile Sustainment activities; and production facility and capability modernization that include plutonium pit production, radiation case manufacturing, special materials for canned subassembly component manufacturing, implementation of enhanced experimental (Enhanced Capabilities for Subcritical Experiments), and computational capabilities (Exascale) required to support the warhead acquisition programs.

Public Law Authorizations

- P.L. 106-65, National Nuclear Security Administration Act, as amended
- P.L. 117-81, National Defense Authorization Act for Fiscal Year 2022
- P.L. 117-103, Consolidated Appropriations Act, 2022

Weapons Activities

	(Dollars in Thousands)				
	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Weapons Activities	**15,345,000**	**15,345,000**	**16,486,298**	**+1,141,298**	**+7.4%**

Overview

Programs funded in the Weapons Activities appropriation support the Nation's current and future defense posture and necessary nationwide infrastructure of science, technology, engineering, and production capabilities without resuming underground nuclear explosive testing. Weapons Activities provides for the maintenance and refurbishment of nuclear weapons to continue sustained confidence in their safety, reliability, military effectiveness; investment in scientific, engineering, manufacturing capabilities for certification of the enduring nuclear weapons stockpile; and manufacture of nuclear weapon components. Weapons Activities also provides for maintenance and investment in the National Nuclear Security Administration (NNSA) nuclear complex infrastructure to be more responsive and resilient.

NNSA's Management and Operating (M&Os) contractors employ approximately 57,000 people across the enterprise, predominantly at eight geographical sites, including Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), Los Alamos National Laboratory (LANL), Nevada National Security Site (NNSS), Pantex, Y-12, Kansas City National Security Campus (KCNSC), and Savannah River Site (SRS). NNSA M&O partners are managed by a Federal workforce composed of civilian and military staff. Additional details about these programs will be included in the FY 2023 Stockpile Stewardship and Management Plan (SSMP).

Highlights and Major Changes in the FY 2023 Budget

Stockpile Management

The Stockpile Management program requirements for FY 2023 maintain a safe, secure, and effective nuclear weapons stockpile. The Stockpile Management program encompasses five major subprograms that directly support the nation's nuclear weapons stockpile. Stockpile Major Modernization will continue Phase 6.6 (Full-Scale Production) activities for the B61-12 LEP (Life Extension Program) and W88 ALT (Alteration) 370, Phase 6.4 (Production Engineering) activities for the W80-4 LEP, Phase 6.3 (Development Engineering) activities for the W87-1 Modification Program, and Phase 2 (Feasibility Study and Design Options) for the W93 Program. Stockpile Sustainment will provide activities to include maintenance, surveillance, assessment, development, and program planning for each Stockpile System and Multi-Weapon Systems and continue Phase 6.3 (Development Engineering) activities for the W76-1/2 Mk4B Shape Stable Nose Tip Retrofit. Weapons Dismantlement and Disposition (WDD) will provide safe and secure dismantlement of nuclear weapons and components in accordance with the Nuclear Weapons Stockpile Plan. Production Operations will sustain manufacturing capabilities and capacities, including process improvements and investments focused on increased efficiency of production performance. FY 2023 includes a new Stockpile Management subprogram, Nuclear Enterprise Assurance (NEA), formulated to prevent, detect, and mitigate potential consequences of subversion to the stockpile and associated capabilities to design, produce, and test nuclear weapons.

<u>Stockpile Major Modernization</u>

The Stockpile Major Modernization subprogram is where all the approved warhead acquisition programs are conducted. The acquisition programs are necessary to extend the expected life of stockpile systems for an additional 20 to 30 years. NNSA, in conjunction with the Department of Defense (DoD), executes an LEP following the Phase 6.X process guidelines, which provides a framework to conduct and manage refurbishment activities for existing weapons. Phase 6.1 (Concept Assessment) should provide sufficient information for the Nuclear Weapons Council (NWC) to authorize Phase 6.2 (Feasibility Study and Design Options). Follow-on phases include Phase 6.2A (Design Definition and Cost Study), Phase 6.3 (Development Engineering), Phase 6.4 (Production Engineering), Phase 6.5 (First Production) and Phase 6.6 (Full-Scale Production). For the purposes of this justification, the term "refurbishment" refers to all nuclear weapon alterations and modifications, including LEPs, modernization, and revised military requirements. The W93 Program modernization activity will use the joint DOE/NNSA-DOD Phase 1-7 weapons acquisition process that is very similar to the Phase 6.X process. The seven phases consist of Phase 1 (Concept Assessment), Phase 2 (Feasibility Study and Design Options), Phase 2A (Design

Definition and Cost Study), Phase 3 (Developmental Engineering), Phase 4 (Production Engineering), Phase 5 (First Production), Phase 6 (Full-Scale Production/Sustainment), and Phase 7 (Retirement, Dismantlement, and Disposal).

Stockpile Sustainment

The Stockpile Sustainment program directly executes maintenance, surveillance, assessment, surety, and management activities for all enduring weapons systems in the stockpile. The program includes the B61, W76, W78, W80, B83, W87, and W88 Stockpile Systems, and Multi-Weapon Systems. The FY 2023 request supports the W76-1/2 Mk4B Shape Stable Nose Tip Retrofit activity.

Weapons Dismantlement and Disposition

The Weapons Dismantlement and Disposition (WDD) program is a critical element of NNSA's integrated effort to transform the enterprise and the stockpile. Specific activities include weapons disassembly, recycling of material and hardware for LEPs, disposition of retired warhead system components, and ensuring components are available for safety testing. Other supporting activities specific to retired warheads include conducting hazard assessments, issuing safety analysis reports, conducting laboratory and production plant safety studies, and declassification and sanitization of component parts. WDD relies on several enabling programs and offices to complete its mission, such as Production Operations for shipping, receiving, and equipment maintenance; Infrastructure and Operations for infrastructure sustainment and containers; and Secure Transportation Asset for the movement of weapons and weapon components.

Production Operations

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 production mission is defined as weapon assembly, weapon disassembly, component production, surveillance, and weapon safety and reliability testing. Production Operations also enables the modernization of production capabilities to improve efficiency and ensure manufacturing operations meet future requirements. Production Operations requires close coordination with the Advanced Manufacturing Development program, which is charged with development and initial deployment of new manufacturing and production capabilities as well as several capability modernization programs to ensure the correct capabilities are in place to support the stockpile demands. Facility major modernization and construction activities are not part of this budget subprogram and are covered in other parts of the Weapons Activities account.

Nuclear Enterprise Assurance (NEA)

Nuclear Enterprise Assurance ensures the Nuclear Security Enterprise (NSE) actively manages adversarial subversion risks to nuclear weapons and associated design, production, and testing capabilities throughout the Phase 6.x lifecycle. NEA enables the responsible use of digital technologies in the modernization of weapons, facilities, and engineering capabilities, by preventing, detecting, and mitigating potential consequences of subversion in digital technologies, the supply chain, and other threat pathways. NEA includes technical and governance activities for the assurance of components integral to weapon systems, operational technologies directly related to weapons, and capabilities that cross-cut multiple weapons programs.

Production Modernization

The Production Modernization program focuses on the production capabilities of nuclear weapons components critical to weapon performance, including primaries, secondaries, radiation cases, and non-nuclear components. The program encompasses five major subprograms that sustain the Nation's nuclear weapons stockpile: Primary Capability Modernization, Secondary Capability Modernization, Tritium and Domestic Uranium Enrichment, Non-Nuclear Capability Modernization, and Capability Based Investments (CBI).

Primary Capability Modernization

The Primary Capability Modernization Program consolidates management of primary stage material processing and component production capabilities in the NNSA nuclear security enterprise. The program includes Plutonium Modernization, the funding efforts across the nuclear security enterprise to restore the Nation's capability to produce 80 plutonium pits per year (ppy), and the High Explosives and Energetics program which focuses on modernization and prioritization of high explosives (HE) processing facilities and qualification of high explosive, pyrotechnic, and propellant materials across the nuclear security enterprise. The program enables the production of HE and energetic materials for nuclear explosive package and non-nuclear components required for an effective stockpile.

Secondary Capability Modernization

The Secondary Capability Modernization program is responsible for restoring and increasing manufacturing capabilities for the secondary stage of nuclear weapons in the nuclear security enterprise. This includes ensuring the availability of strategic materials and other sub-component material streams that are managed by NNSA, as well as modernizing the facilities and operations required to process these materials, fabricate, and assemble the final components. The program includes Uranium Modernization (which consolidates Uranium Sustainment and Process Technology Development investments), Depleted Uranium Modernization, and Lithium Modernization activities.

Uranium Modernization

The Uranium Modernization program provides funding to modernize enriched uranium operations to ensure delivery of secondary components needed to maintain the stockpile and support Naval Reactors and Nonproliferation programs.

The program modernizes existing enriched uranium capabilities through the development and deployment of new technologies into existing facilities to reduce cost and improve manufacturing processes for nuclear weapon materials. These new technologies improve existing Building 9212 capabilities by shortening production schedules, reducing risks, and enhancing personnel safety. The installation and operation of these systems in existing facilities will allow for the current aqueous-based chemical recovery and high-hazard metal conversion processes to be shut down. This effort entails continuing to support the three current major items of equipment (MIE) and associated technology development efforts: Electrorefining, Calciner, and Direct Chip Melt.

Depleted Uranium Modernization

The Depleted Uranium (DU) Modernization Program enables the restart of lapsed capabilities to ensure NNSA can meet imminent mission requirements. These capabilities lapsed in the early 2000s due to the reuse of materials, weak demand signals, and prioritization of other activities. These capabilities include feedstock procurement, restarting and maintaining DU and DU-niobium alloying and manufacturing capabilities, and investing in key new technologies.

Lithium Modernization

The Lithium Modernization program maintains the production of the nation’s enriched lithium supply in support of Defense Programs, Department of Energy (DOE) Office of Science, Department of Homeland Security, and other customers. In addition, the program manages technology development that improves the efficiency and reliability of the existing lithium capability and the future Lithium Processing Facility (LPF).

Tritium and Domestic Uranium Enrichment

The Tritium Modernization and Domestic Uranium Enrichment program is responsible for producing tritium and supplying unobligated low-enriched uranium to support national security needs. The program includes Tritium Modernization and Domestic Uranium Enrichment.

The Tritium Modernization Program operates the national capability for producing, recovering, and recycling tritium, and it is expanding capacity to meet increased national security requirements. Since FY 2003, NNSA has been producing tritium by irradiating tritium-producing burnable absorber rods (TPBAR) in the Watts Bar Unit 1 (WBN1) nuclear power reactor operated by the Tennessee Valley Authority. In FY 2021, tritium production began in Watts Bar Unit 2 (WBN2) as well. Tritium recovery and recycling is completed at the SRS, where tritium is recovered from gas transfer systems, purified, and returned to the pipeline for future use.

The Domestic Uranium Enrichment (DUE) program is responsible for ensuring a reliable supply of enriched uranium to support national security. The DUE program provides unobligated, low-enriched uranium (LEU) for tritium production by managing existing uranium stocks and downblending highly enriched uranium (HEU) declared excess to national security needs. LEU inventories identified by the DUE program will sustain tritium production through 2044, at which point the United States will require a new domestic uranium enrichment capability to meet tritium production and other national security needs. The DUE program preserves and advances uranium enrichment technology for potential future deployment to meet national security needs.

Non-Nuclear Capability Modernization

The Non-Nuclear Capability Modernization program provides funding to modernize production of non-nuclear components for multiple weapon systems. Non-nuclear components are a significant portion of the costs for the stockpile modernization programs due to the number of parts, complexity, and testing of the warhead. This program consolidates management and oversight of strategic investments in technology, equipment, infrastructure, tools, and materials. Specifically, the program focuses on improving and/or increasing the capability and capacity of the nuclear security enterprise to manufacture stockpile components in categories that include (but are not limited to) Cable Assemblies, Neutron Generators, Polymers, Electronic Assemblies, Gas Transfer System Production, Microelectronics Packaging, Power Sources, Radiation Hardened Microelectronics, Testers, and Lightning Arrest Connectors.

Capability Based Investments

The Capability Based Investments (CBI) program executes projects to replace or enhance core enterprise capabilities through recapitalization of high risk of failure test, measurement, and production equipment. CBI addresses enduring, multi-program requirements through discrete, short-duration projects. These investments recapitalize scientific and manufacturing capabilities that have degraded due to aging, broken, or outdated equipment and supporting systems. CBI activities primarily include capital equipment purchases and minor construction projects that enable installation and use of the equipment and associated capabilities. These investments address needs beyond any single facility, campaign, or weapon system and are essential to achieving Defense Programs mission objectives. The CBI portfolio reduces risks to mission and ensures needed capabilities are available for stockpile stewardship, sustainment, and modernization.

Stockpile Research, Technology, and Engineering

Stockpile Research, Technology, and Engineering (SRT&E) provides the data and tools that underpin science-based stockpile decisions, along with the development and maturation of component and manufacturing technologies for future insertion in the stockpile, focuses on the most pressing investments the nuclear security enterprise needs to meet DoD warhead needs and schedules, and enables assessment and certification capabilities used throughout the nuclear security enterprise. The program provides the knowledge and expertise needed to maintain confidence in the nuclear stockpile without the need for underground nuclear explosive testing. Funding requested in FY 2023 supports the continued implementation of the Enhanced Capabilities for Subcritical Experiments (ECSE) and various activities in preparation to accept and operate NNSA's first Exascale high performance computing system for program use in 2023. Both of these capabilities are needed to support W80-4 LEP design validation and W87-1 Modification certification requirements. In addition, the funding supports the necessary development of the design, engineering, and adaptation of physics and engineering codes needed to support stockpile decisions to operate on this new platform. Funding in this area also supports the development of new materials, technologies, and processes to evolve our nuclear systems and production complex. This is accomplished through warhead component and production technology development and maturation needed for ongoing, planned, and future warhead modernization programs. It also reinvigorates and develops the future generation of the highly trained technical and specialized workforce by experimental and computational programs along with academic institutions. The program includes Assessment Science, Engineering and Integrated Assessments, Inertial Confinement Fusion, Advanced Simulation and Computing, Weapon Technology and Manufacturing Maturation, and Academic Programs.

The reduced request for SRT&E in FY 2023 by $108,831,000 is comprised of changes to the subprograms. Assessment Science decreased funding due to fewer funding needs for U1a Complex Enhancements. Engineering and Integrated Assessments increased funding to support the planned line-item project Combined Radiation Environments for Survivability Testing (CREST) facility and support pre-Phase X/6.X studies and feasibility assessments. Inertial Confinement Fusion decreased funding to prioritize support for maturing experimental platforms to execute High Energy Density (HED) experiments critical to supporting stockpile needs. Advanced Simulation and Computing decreased funding due to the planned conclusion of funding for the Exascale Computing Facility Modernization project. Weapon Technology and Manufacturing Maturation decreased funding due to a transfer of quality assurance scope and funding to Stockpile Management, Production Operations, and Production Modernization. Academic Programs slightly decreased funding due to reprioritization in SSAA Centers' focus while supporting existing awards until completion.

Assessment Science

The Assessment Science program provides the knowledge and expertise needed to maintain confidence in the nuclear stockpile in the absence of nuclear explosive testing. Capabilities developed and maintained in the Assessment Science program support the entire Nuclear Weapons Complex, providing (1) the scientific underpinnings required to conduct annual assessments of weapon performance and certification of life extension programs (LEPs), (2) the scientific insight necessary to inform our understanding of the impacts of surveillance findings to ensure that the nuclear stockpile remains safe, secure, and effective, and (3) the core technical expertise required to be responsive to technical developments and geopolitical drivers. Assessment Science also facilitates the assessment of current weapon and weapon component lifetimes, the development and qualification of modern materials and manufacturing processes, the exploration of concepts for component reuse, and the development of modern safety concepts for sustainment.

Assessment Science performs experiments to obtain the materials and nuclear data required to validate and understand the physics of nuclear weapons performance. These include hydrodynamic and subcritical experiments used to obtain data on the dynamic behavior of plutonium and surrogate materials in integrated geometries. Science program experiments and data analyses also facilitate safety, security, and evaluations of sustainment concepts without the need for additional nuclear explosive testing. These activities serve to develop, exercise, and maintain the expertise and competence of the nuclear weapon design, engineering, and assessment community that resides at the national security laboratories and nuclear weapons production facilities. This compendium of weapons-relevant data is acquired using unique, small- and large-scale experimental facilities throughout the DOE nuclear security enterprise.

Engineering and Integrated Assessments

The Engineering and Integrated Assessments Program is responsible for ensuring system agnostic survivability in present and future stockpile-to-target sequences (STS) and ensures a responsive nuclear deterrent through collaborative partnerships, proactive integration, and assessments. This program supports four key mission areas: (1) strengthening the science, technology, and engineering base by maturing advanced technologies to improve future weapon systems, (2) providing tools for qualifying weapon components and certifying weapons without nuclear explosive testing, (3) supporting annual stockpile assessments through improved weapons surveillance technologies and warhead component aging assessments, and (4) providing capabilities that accelerate the nuclear weapons acquisition process and strengthen the ability of the United States to respond to unexpected developments that could threaten nuclear security.

Inertial Confinement Fusion

The Inertial Confinement Fusion (ICF) Program provides high energy density (HED) science capabilities and expertise that support research and testing across the breadth of the Stockpile Stewardship Program. Its two-fold mission is to meet immediate and emerging HED science needs to support the deterrent of today, and to advance the research and development (R&D) capabilities necessary to meet those needs for the deterrent of the future. The ICF program enables access to and study of the HED regime through (1) the design and execution of complex physics experiments to improve our fundamental science understanding; (2) the development of instrumentation to diagnose physics phenomena at the extreme temperature, pressure, and density conditions relevant to nuclear weapons performance; and (3) the development and operation of experimental facilities capable of reaching those conditions. The ICF program's flagship facilities, the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL), the Z pulsed power facility (Z) at Sandia National Laboratories (SNL), and the Omega Laser Facility (Omega) at the University of Rochester's Laboratory for Laser Energetics (LLE), represent a complementary set of capabilities designed to meet the diverse needs of weapons physics, the pursuit of ignition, and the exploration of fundamental HED science.

Advanced Simulation and Computing

The Advanced Simulation and Computing (ASC) program provides high-end simulation capabilities (e.g., modeling codes, computing platforms, and supporting infrastructure) to meet the requirements of the Stockpile Stewardship Program (SSP). Modeling the complexity of nuclear weapons systems is essential to maintaining confidence in the performance of our stockpile without underground nuclear testing. The ASC program provides the weapon codes that provide the integrated assessment capability supporting annual assessment and future sustainment program qualification and certification of the stockpile. ASC is an integral element of the Stewardship Capability Delivery Schedule. ASC provides critical capabilities that help inform decision making related to the sustainment of the nuclear stockpile in support of U.S. national security objectives. The program also coordinates with other NNSA programs and other government agencies, including the intelligence community, to support nonproliferation, emergency response, nuclear forensics, and attribution activities. ASC will deliver the El Capitan system in FY 2023.

Weapon Technology and Manufacturing Maturation
The Weapon Technology and Manufacturing Maturation program is responsible for developing agile, affordable, assured, and responsive technologies and capabilities for nuclear stockpile sustainment and modernization to enable Defense Programs' mission success. The efforts enable evolving stockpile and production capabilities away from legacy systems and processes, providing for resilience, and laying the foundation for future success of the nuclear security enterprise. The core areas of work in FY 2023 include agile, assured, and affordable technologies; partnership with stakeholders to meet stockpile and customer requirements; qualification and certification; developing a skilled technical workforce, and establishing enhanced capabilities

Academic Programs
The challenges of modernizing our nuclear stockpile demand a strong and diverse base of national expertise and educational opportunities in specialized technical areas that uniquely contribute to nuclear stockpile stewardship. The Academic Programs are designed to support academic programs in science and engineering disciplines of critical importance to the nuclear security enterprise, such as, nuclear science, radiochemistry, materials at extreme conditions, high energy density science, advanced manufacturing, and high-performance computing. In addition, building a diverse workforce will strengthen our stewardship of the future. Funding in this area directly supports the President's Executive Order on Advancing Racial Equity and Support for Underserved Communities through the Federal Government. The Minority Serving Institutions Partnership Program (MSIPP) within Academic Programs helps develop the next generation of diverse, highly trained technical workers able to support NNSA's core missions. MSIPP also reinvigorates and develops the future generation of the highly trained and specialized technical workforce by experimental and computational programs along with academic institutions. The role of the broader collection of Academic Programs is three-fold: (1) Develop the next generation of highly trained technical workers able to support its core mission; (2) Maintain technical peer expertise external to the nuclear security enterprise for providing valuable oversight, cross-check, and review; and (3) Enable scientific innovation to enhance the nuclear security enterprise missions to strengthen the basic fields of research relevant to the NNSA mission.

Infrastructure and Operations (I&O)
The program maintains, operates, and modernizes NNSA's infrastructure in a safe, secure, and cost-effective manner to support program execution while seeking to maximize return on investment and reduce enterprise risk. The program also plans, prioritizes, and constructs facilities and infrastructure to support all NNSA programs, with the exception of programmatic construction projects, which are funded by the capability sponsor. Infrastructure and Operations consists of the following programs: Operations of Facilities, Safety and Environmental Operations, Maintenance and Repair of Facilities, Recapitalization, and Line-Item Construction Projects. Operations of Facilities funds the NNSA facilities to operate in a safe and secure manner and is critical to achieving the administration's plutonium, uranium, tritium, lithium, high explosives, and other mission objectives. This program includes essential support such as water and electrical utilities, safety systems, lease agreements, and activities associated with Federal, state, and local environmental, worker safety, and health regulations. The Safety and Environmental Operations program provides for the Department's Nuclear Criticality Safety Program (NCSP), Nuclear Safety Research and Development (NSR&D), Packaging subprogram, Long Term Stewardship (LTS) subprogram and Nuclear Materials Integration (NMI) subprogram. These activities support safe, efficient operation of the nuclear security enterprise through the provision of safety data, nuclear material packaging, environmental monitoring, and nuclear material tracking.

The Maintenance and Repair of Facilities program directly funds maintenance activities across the NNSA enterprise for the recurring day-to-day work required to sustain and preserve NNSA facilities in a condition suitable for their designated purpose. These efforts include predictive, preventive, and corrective maintenance activities to maintain facilities, property, assets, systems, roads, and vital safety systems. The Recapitalization program, comprised of the Infrastructure and Safety subprogram, is key to modernizing NNSA's infrastructure. A sustained investment in Recapitalization is needed to address numerous obsolete support and safety systems; revitalize facilities that are beyond the end of their design life; and improve the reliability, efficiency, and capability of core infrastructure to meet mission requirements. The Recapitalization program modernizes NNSA's infrastructure by prioritizing investments to improve the condition and extend the life of structures, capabilities, and systems thereby improving the safety and quality of the workplace. Recapitalization investments help achieve operational efficiencies and reduce safety, security, environmental, and program risk. The program also includes minor construction and infrastructure upgrade projects, real property purchases, planning, Other Project Costs (OPC) for Infrastructure and Operations funded mission enabling infrastructure, and deactivation and disposal of excess infrastructure. Infrastructure and Operations line-item construction projects are critical to revitalizing the infrastructure. These projects will replace obsolete, unreliable facilities and infrastructure to reduce safety and program risk while improving responsiveness, capacity, and capabilities.

Secure Transportation Asset
The Secure Transportation Asset (STA) provides safe, secure transport of the Nation's nuclear weapons, weapon components, and special nuclear material throughout the nuclear security enterprise to meet nuclear security requirements and support the broader NNSA and DOE operations. Nuclear weapon life-extension programs, limited-life component exchanges, surveillance, dismantlement, nonproliferation activities, and experimental programs rely on transport of STA cargos on schedule and in a safe and secure manner. The STA program includes the Operations and Equipment and Program Direction subprograms. The Operations and Equipment subprogram provides the STA's transportation service infrastructure required to meet NNSA's nuclear security activities as outlined in the FY 2023 Stockpile Stewardship and Management Plan. The Program Direction subprogram provides salaries, travel, and other related expenses in support of Federal Agents (FA) and the secure transportation workforce.

STA currently has the mission capacity to meet NNSA stockpile sustainment priorities, strategic material and component transfers, and other DOE workloads. STA will continue to balance and prioritize customer requests against capacity. Since its establishment in 1974, STA has maintained its legacy of safety and security to include no loss of cargo and no radiological release on any shipment.

Defense Nuclear Security
The Office of Defense Nuclear Security (DNS) leads, develops, and implements the National Nuclear Security Administration's (NNSA) security program to enable NNSA's nuclear security enterprise (NSE) missions. DNS provides protection for NNSA personnel, facilities, nuclear weapons, and materials from a full spectrum of threats, ranging from minor security incidents to acts of terrorism, at its national laboratories, production plants, processing facilities, and the Nevada National Security Site (NNSS). In addition, DNS provides nuclear security expertise for a broad set of 21st century national security needs, in line with its core mission, such as those in defense nuclear nonproliferation, homeland security, and intelligence. Employing more than 1,700 Protective Force officers, DNS secures more than 5,000 buildings and protects more than 57,000 personnel.

Information Technology and Cybersecurity
The Office of the Associate Administrator for Information Management and Chief Information Officer (OCIO) is responsible for information sharing and information safeguarding to support the mission of NNSA and execute the President's Executive Order to Improve the Nation's Cybersecurity. The OCIO supports Information Technology (IT) and cybersecurity services and solutions, which includes continuous monitoring, cloud-based technologies, and enterprise security technologies (i.e., identity, credential, and access management) to help meet security challenges. The IT and Cybersecurity Program is based on practical principles that provide superior information management support to current operations, while implementing unclassified and classified cloud-based technologies and infrastructure to support the Nuclear Security Enterprise. The OCIO prioritizes the implementation of a strong and comprehensive IT and Cybersecurity Program to support the nuclear security enterprise mission, to protect and defend nuclear security enterprise information, information assets of sites, employees, and the public. The program collaborates with the DOE Office of the Chief Information Officer (DOE OCIO) on IT and cybersecurity solutions providing protection for DOE information and information assets.

FY 2024 – FY 2027 Key Milestones
- **<u>Stockpile Management</u>**
  - Execute B61-12 aircraft integration activities with U.S. Air Force B-21 bomber and Dual Capable Aircraft throughout FY 2024 - FY 2027 and complete B61-12 Pantex Last Production Unit and life-of-program component overbuilds by FY 2026.

- Complete W80-4 LEP System Final Design Review in FY 2024, receive W80-4 LEP Phase 6.5 (First Production) Authorization and produce First Production Unit (FPU) in FY 2025, conduct W80-4 LEP System and Warhead Production Steady State Gate in FY 2026, and receive Phase 6.6 (Full-Scale Production Authorization) in FY 2026.
- Conduct, in conjunction with the Air Force, Sentinel GBSD environmental flight tests in Mk21A in FY 2024 and FY 2025, complete W87-1 Component Baseline Design Reviews in FY 2024 and FY 2025, complete W87-1 System Baseline Design Review in FY 2025, complete W87-1 Baseline Cost Report and enter Phase 6.4 (Production Engineering) in FY 2026, and conduct, in conjunction with the Air Force, W87-1 JTA development flight tests in FY 2026 and FY 2027.
- Complete W93 Program Phase 2 (Feasibility Study and Design Options), complete W93 Program Phase 2A (Design Definition and Cost Study) in FY 2025/2026 including the Weapon Design and Cost Report (WDCR), and obtain W93 Program Phase 3 (Development Engineering) authorization.

- **<u>Production Modernization</u>**
  - Achieve 10 pits per year production capability (2024), CD-2/3 for SRPPF (2024), 30 pits per year production capability (2026), and complete equipment replacement and refurb projects at LANL that support the roadmap to 30 pits per year by FY 2026.
  - Achieve CD-4 approval for the HE Science and Engineering (HESE) Facility, CD-2/3 approval for the HE Synthesis, Formulation, and Production (HESFP) Facility, and CD-2/3 approval for the Energetic Materials Characterization (EMC) Facility.
  - Deactivate the wet chemistry process in Building 9212 at Y-12, reducing operational and safety risks and initiate work to fabricate, install direct chip melt bottom loading furnaces in Building 9215 expanding capacity to process chips, and achieve Target Working Inventory within Area 5 to phase out mission dependency on Building 9212, enhancing the safety of existing facilities that will be operational through the 2040s.
  - Increase production to 2,800 grams of tritium over an 18-month reactor cycle by 2024. Further ramp up production levels, reliably producing 3,300 grams by 2025.
- **<u>SRT&E</u>**
  - Mature the technology for cinematographic radiography for future hydrodynamic and sub-critical experiments to provide a robust test of the predictive capability of weapons design codes and help reduce the need for nuclear explosive testing.
  - Advance revolutionary radiography and other diagnostics as well as modernize data analysis techniques and models to increase learning from dynamic experiments (e.g., surrogate and plutonium experiments supporting stockpile assessments and LEP developments) through delivery of high-fidelity data which may provide a better test of current codes, reducing the need for nuclear explosive testing.
  - Complete the U1a Complex 03 Test Bed in preparation for dynamic neutron diagnosed subcritical experiments (NDSE) experiments in FY 2024, the Advanced Sources and Detectors (ASD) project in FY 2025, execute subcritical experiments in the U1a Complex 03 Test Bed using NDSE in FY 2025, and execute subcritical experiments in the U1a Complex 100 Test Bed using ASD in FY 2026 and FY 2027.
  - Demonstrate a mature optical initiation system, technology readiness level (TRL) 5 & manufacturing readiness level (MRL) 3 for next insertion option such as the W93, continue focused development of a multi-point safety design concept that can be qualified for a future insertion opportunity, continue limited development of improved power management technologies tailored to modernized applications, and develop advanced safety mechanisms and demonstrate technologies on a relevant demonstrator.
  - Develop a distributed bus-based architecture (DBBA) that provides an electrically stable yet flexible digital interface that forms the key enabling element of a modular theme. This approach replaces the traditional highly optimized analog interface architectures used by existing weapons systems.
  - Demonstrate methodology for born qualified additively manufactured cushions and pads using automated on-machine metrology and in-situ process monitoring to enable quicker production for future systems, stand up pilot plant to enable recycling and recovery of valuable special material for future systems, continue to work towards qualification of additively manufactured and particle injection molded high explosives and mock, continue to develop advanced coating technologies in time for the W93 and future systems.
- **<u>Infrastructure and Operations</u>**
  - Provide support for pit production , with a focus on the LANL production mission of at least 30 pits per year, major modernization programs, and other NNSA missions such as nonproliferation and counterterrorism. The program also supports efforts to reduce Deferred Maintenance (DM) and Repair Needs (RN) and continuing to modernize

NNSA's infrastructure to reduce mission and safety risks through the application of an enterprise risk management methodology
  - Support line item construction investments largely directed to mission enabling infrastructure.
  - Seek operational efficiencies by deactivating and dispositioning facilities that are no longer needed, thereby reducing operations, maintenance, and recapitalization requirements.
- **Secure Transportation Asset**
  - Delivery of Mobile Guardian Transport FPU in FY 2026.
  - Life Cycle Replacement of first 737 in FY 2027
- **Defense Nuclear Security**
  - Complete the West End Protected Area Reduction (WEPAR) project at Y-12
  - Complete critical SIRP projects, which aligns with NNSA's priority to recapitalize security infrastructure
- **Information Technology and Cybersecurity**
  - Establish additional Centers of Excellence to improve and enhance cyber security operations throughout the nuclear security enterprise in FY 2025.
  - Reinforce security posture for highly classified information and enhancing the capability to share information with the Department of Defense (DoD). This includes modernizing the network architecture, as well as upgrades and enhancing security capabilities for the classified systems, including the Emergency Communications Network (ECN).
  - Develop architecture of the classified wireless network for non-pit production facilities.
  - Develop a roadmap to support and sustain advanced analytic capabilities, including artificial intelligence and machine learning, from the research and development phase to production and deployment.

FY 2021 Accomplishments

- **Stockpile Management**
  - Achieved FPU on 115 of 115 B61-12 weapon components including all six Base Metal Electrode (BME) capacitor affected components and completed seven B61-12 system joint flight tests on PA-200, F-16 Mid-Life Upgrade (MLU), and F-35A aircraft platforms. Completed all four B61-12 First Production Capability Units (FPCU) activities at Pantex, including two Weapons Evaluation Test Laboratory (WETL) system level testing and two Development Joint Test Assembly (DJTA) builds.
  - Completed W88 ALT 370 System FPU in July 2021 and Joint Test Assembly 8 FPU in September 2021.
  - Completed W80-4 LEP Program Protection Plan (PPP), Nuclear Explosive Package (NEP) Certification Plan, and the Nuclear Weapon Subsystem Test Plan (NWSSTP). Kicked off the W80-4 LEP Baseline Cost Report development in March 2021 and the Preliminary Design Review and Acceptance Group in August 2021.
  - Finalized and documented W87-1 down-select decisions and documented component design trades, completed W87-1 initial design definition discussions between the Design Agencies and Production Agencies, formalized W87-1/Mk21A Memorandum of Understanding with Air Force, and completed W87-1 down select to single warhead architecture and entered Phase 6.2A (Design Definition and Cost Study).
- **Production Modernization**
  - Successfully produced pits in PF-4 to support process qualification and product certification enabling war reserve (WR) pit production to begin in 2023 and installed equipment in PF-4 to support production ramp up to 10 ppy in 2024.
  - Achieved CD-1 and awarded the preliminary and final design contract for HESFP and completed Analysis of Alternatives for the EMC facility, achieved PEI1 subproject (04-D-125-05) CD-4 approval over one year ahead of schedule, and obtained the Los Alamos Plutonium Pit Production Project (LAP4) CD-1 in April 2021, TA-55 Reinvestments Project Phase III (TRP-III) CD-1/2/3 in May 2021, and the Savannah River Plutonium Processing Facility (SRPPF) CD-1 in June 2021.
  - Continued down-blending campaign, which successfully delivered unobligated LEU on schedule and continued the acquisition process towards Approval of Alternative Selection and Cost Range CD-1 for a domestic uranium enrichment capability.
  - Initiated the Next Generation Life Extension Program Research and Development Component Fabrication Facility (NextGen Fabrication Facility) study to identify option for a joint Design Agency-Production Agency collaborative space and testbed that can assess, develop, tailor, and transition new manufacturing technologies and designs that

will enable NNSA to accelerate the development and production of non-nuclear components for future modernization programs.

- **SRT&E**
  - Completed the third series of high explosive tests on the inner plutonium confinement vessel (IPCV) design for the Pu@pRad project. The test series included 125% over-pressure experiments, both with and without fragment mitigation in the IPCV.
  - Delivered plutonium data and supported facility operations on JASPER, Z, and TA-55 to validate the plutonium equation-of-state (EOS) and plutonium aging models directly relevant to stockpile assessments, stockpile certification, and future stockpile options including the B61-12 LEP and W87-1 Modification programs.
  - Established a new production unclassified restricted enclave at LANL for new high performance computing (HPC) services in support of tri-lab Remote Computing Enablement (RCE), continued production operation of Trinity (ATS-1) and CTS-1 systems Snow, Fire, Ice, and Cyclone in full production use, achieved 89% completion of the Exascale Computing Facility Modernization (ECFM) construction project at LLNL, completed the B654 Low Conductivity Water Cooling Loop for future CTS systems at LLNL, and installed power, cooling, and networking infrastructure for CTS-2 systems in conjunction with the 3MW power upgrade to the 725-East HPC Facility at SNL.
  - Completed the Ground Test 2 (GT2) and Ground Test 3B (GT3B) series of experiments demonstrating a new reentry vibration qualification workflow for a subsystem, a full system re-entry body in a Mk5-like envelope, and a modular full-system re-entry body.
  - Transitioned Small Ferroelectric Neutron Generator (SFENG) to W87-1. Its new detonator improves safety, performance, and shelf life; and its new cylindrical shape improves producibility.
  - Matured the Direct Cast production process to TRL 6 MRL 4, having produced high fidelity components in a simulated operational environment, thus transitioning the Direct Casting Technology Realization Team to NA-195 for further development and implementation into Y-12 production.
  - Completed a first of its kind, Odin's Tesseract pRAD experiment at LANL that demonstrated near identical behavior between electrical and optical fire sets. This is a significant milestone in the development of an Optical Initiation system.
- **Infrastructure and Operations**
  - Completed 65 Recapitalization projects and 11 Disposition projects – 19 assets demolished (28,569 sq ft), including nine process-contaminated facilities.
  - Provided technical infrastructure, expertise, and experimentation capabilities for the DOE encompassing Nuclear Data, Analytical Methods, Training & Education, Information Preservation and Dissemination, and Integral Experiments.
  - Conducted projects to provide the technical foundation for safety analyses and controls as well as authorization basis decision making for NNSA nuclear facilities and associated operations.
  - Conducted maintenance and repair of facilities at KCNSC, LLNL, LANL, NNSS, Pantex, SNL, SRS, and Y-12 to improve equipment, waste management, facility functionality, and critical operations.
  - Completed 14 TRU waste shipments from LLNL and 49 total WIPP shipments (1,241 containers) from RANT at LANL.
  - Completed first production unit for the DPP-3 package.
- **Secure Transportation Asset**
  - Completed over 108 weapon/special nuclear materials shipments and made over 62 limited-life component deliveries without incident, completed 737 aircraft procurement (replacing DC-9).
  - Completed the Baseline Design Review for the Mobile Guardian Transporter (MGT).
- **Defense Nuclear Security**
  - Continued upgrades to CATS, developed the Safeguards and Security (S&S) Career Path Guide, began the WEPAR project at Y-12, demonstrated initial capability of Caerus, achieved initial operating capability at NNSS, and initiated construction efforts at both Pantex and Y-12, in support of the installation efforts of the Counter Unmanned Aircraft System (CUAS) platform.
  - Completed Phase 3, Analysis Phase, of the Design Basis Threat (DBT) Implementation Strategy, successfully deployed Portable Intrusion Detection System (PIDS) units for use at Y-12 in support of the WEPAR, Security Infrastructure Revitalization Program (SIRP), and Uranium Processing Facility (UPF) projects, and continued to ensure security operations could support all NNSA requirements during the COVID-19 pandemic through a multitude of contracting, policy, and logistical modifications.

- **Information Technology and Cybersecurity**
    - Implemented Phase I of the IT Modernization Project by working closely with the Department and element CIOs and IT Managers to move to Windows 10 and Microsoft 365.
    - Completed initial operating capability of NNSA's network modeling and risk scoring platform enabling for a more resilient enterprise.
    - Completed the replacement of the Information Assurance Response Center (IARC) Enterprise Security Information and Event Management (SIEM) tool enhancing continuous monitoring, threat detection, and rapid investigation and response.
    - Completed the recapitalization of NNSA's deployed sensor platform enhancing deployed monitoring capabilities.

Legacy Contractor Pensions and Settlement Payments
This budget line includes funding for the Requa settlement reached in 2019 as well as a portion of an unfunded pension liability at the Savannah River Site in addition to DOE's annual reimbursement made to the University of California (UC) Retirement Plan (UCRP) for former UC employees and annuitants who worked at the Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (LANL).

The *Requa* lawsuit involved UC employees of LLNL who retired prior to the Laboratory's transition to a new contractor on October 1, 2007. The retirees had been receiving health insurance through a UC health plan but when the LLNL contract transitioned to LLNS, the employees were offered health insurance through the new LLNL contractor, leading the retirees to file a lawsuit seeking reinstatement into the UC health plan. The parties settled the lawsuit in 2019, and a final judgment was issued in April 2020. NNSA agreed, pursuant to the legacy UC-LLNL Contract, to provide UC a portion of the total costs to settle the lawsuit, over a period of seven years through FY 2026. NNSA's responsibility for FY 2023 is $9 million.

Funding is also requested for reimbursement of NNSA's portion of the unfunded liability of the Savannah River Nuclear Solutions pensions plan. The FY 2023 Request includes a total of $218 million for this liability with 60 percent allocated to the Office of Environmental Management (EM) and 40 percent allocated to NNSA. NNSA's portion is allocated between the DNN and Weapons Activities appropriation accounts.

This budget line also continues to include the Weapons Activities share of the DOE's annual reimbursement made to the University of California (UC) Retirement Plan (UCRP) for former UC employees and annuitants who worked at the Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (LANL). The annual reimbursement is based on the actuarial valuation report and an annual assessment provided by UC and is covered by the terms described in the contracts. These contracts are paid through the Legacy Contractor Pensions and settlement payments line item.

The Weapons Activities share of these costs in the FY 2023 Budget is $114,632,000.

Entry Level Hires
The NNSA supports a variety of programs to help train and recruit the next generation of leaders in managing the nuclear stockpile, nonproliferation, nuclear security, and international security, such as the NNSA Graduate Fellowship Program (NGFP), the Minority Serving Institutions Partnership Program (MSIPP), and, where appropriate, the Presidential Management Fellows (PMF) program. These programs foster the pipeline of qualified professionals who will sustain expertise in these areas through future employment within the NNSA nuclear security enterprise. In FY 2023, the Weapons Activities appropriation projects providing $5.5 million for NGFP support and development activities.

DOE Working Capital Fund (WCF) Support
NNSA Weapons Activities appropriation projected contribution to the DOE WCF for FY 2023 is $32,903,000. This funding covers certain shared enterprise activities including managing enterprise-wide systems, data, and telecommunications and supporting the integrated acquisition environment.

Weapons Activities[a]
Funding by Program

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Weapons Activities Appropriation					
Stockpile Management					
B61-12 LEP	815,710	815,710	672,019	-143,691	-17.6%
W88 ALT 370	256,922	256,922	162,057	-94,865	-36.9%
W80-4 LEP	1,000,314	1,000,314	1,122,451	+122,137	+12.2%
W80-4 ALT-SLCM	0	0	0	0	0%
W87-1 Modification Program	541,000	541,000	680,127	+139,127	+25.7%
W93 Program	53,000	53,000	240,509	+187,509	+353.8%
Total, Stockpile Major Modernization	**2,666,946**	**2,666,946**	**2,877,163**	**+210,217**	**+7.9%**
Stockpile Sustainment	**998,357**	**998,357**	**1,321,139**	+322,782	+32.3%
Weapons Dismantlement and Disposition	**56,000**	**56,000**	**50,966**	-5,034	-9.0%
Production Operations	**568,941**	**568,941**	**630,894**	+61,953	+10.9%
Nuclear Enterprise Assurance	**0**	**0**	**48,911**	+48,911	0%
Total, Stockpile Management	**4,290,244**	**4,290,244**	**4,929,073**	**+638,829**	**+14.9%**
Production Modernization					
Primary Capability Modernization					
Plutonium Modernization					
Los Alamos Plutonium Modernization					
Los Alamos Plutonium Operations	610,599	610,599	767,412	+156,813	+25.7%
21-D-512, Plutonium Pit Production Project, LANL	226,000	226,000	588,234	+362,234	+160.3%
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL	30,000	30,000	30,002	+2	0%
07-D-220-04, Transuranic Liquid Waste Facility, LANL	36,687	36,687	24,759	-11,928	-32.5%
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL	169,427	169,427	162,012	-7,415	-4.4%
Total, Los Alamos Plutonium Modernization	**1,072,713**	**1,072,713**	**1,572,419**	**+499,706**	**+46.6%**

[a] The FY 2021 and FY 2022 amounts are comparable with FY 2023 proposed structure. NNSA restructured the Weapons Activities budget in FY 2021 to enable better alignment of portfolios with resources. This allowed improved prioritization within portfolios that have multiple programs and interdependencies. Further refinements are proposed in FY 2023 to align programmatic construction with the portfolio each project supports, as well as the move of CBI from I&O to Production Modernization.

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Savannah River Plutonium Modernization					
Savannah River Plutonium Operations	200,000	200,000	58,300	-141,700	-70.9%
21-D-511, Savannah River Plutonium Processing Facility, SRS	241,896	241,896	700,000	+458,104	+189.4%
Total, Savannah River Plutonium Modernization	**441,896**	**441,896**	**758,300**	**+316,404**	**+71.6%**
Enterprise Plutonium Support	90,782	90,782	88,993	-1,789	-2.0%
Total, Plutonium Modernization	**1,605,391**	**1,605,391**	**2,419,712**	**+814,321**	**+50.7%**
High Explosives & Energetics					
High Explosives & Energetics	67,370	67,370	101,380	+34,010	+50.5%
23-D-516 Energetic Materials Characterization Facility, LANL	0	0	19,000	+19,000	0%
21-D-510 HE Synthesis, Formulation, and Production, PX	31,000	31,000	108,000	+77,000	+248.4%
15-D-301 HE Science & Engineering Facility, PX	43,000	43,000	20,000	-23,000	-53.5%
Total, High Explosives & Energetics	**141,370**	**141,370**	**248,380**	**+107,010**	**+75.7%**
Total, Primary Capability Modernization	**1,746,761**	**1,746,761**	**2,668,092**	**+921,331**	**+52.7%**
Secondary Capability Modernization					
Uranium Modernization	306,689	306,689	297,531	-9,158	-3.0%
Depleted Uranium Modernization	110,915	110,915	170,171	+59,256	+53.4%
Lithium Modernization	39,400	39,400	68,661	+29,261	+74.3%
18-D-690, Lithium Processing Facility, Y-12	109,405	109,405	216,886	+107,481	+98.2%
06-D-141, Uranium Processing Facility, Y-12	750,000	750,000	362,000	-388,000	-51.7%
Total, Secondary Capability Modernization	**1,316,409**	**1,316,409**	**1,115,249**	**-201,160**	**-15.3%**
Tritium and Domestic Uranium Enrichment					
Tritium Sustainment and Modernization	312,109	312,109	361,797	+49,688	+15.9%
Domestic Uranium Enrichment	160,000	160,000	144,852	-15,148	-9.5%
Uranium Reserve	75,000	75,000	0	-75,000	-100.0%
18-D-650 Tritium Finishing Facility, SRS	27,000	27,000	73,300	+46,300	+171.5%
Total, Tritium and Domestic Uranium Enrichment	**574,109**	**574,109**	**579,949**	**+5,840**	**+1.0%**

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
	(Dollars in Thousands)				
Non-Nuclear Capability Modernization					
Non-Nuclear Capability Modernization	107,137	107,137	123,084	+15,947	+14.9%
Total, Non-Nuclear Capability Modernization	**107,137**	**107,137**	**123,084**	**+15,947**	**+14.9%**
Capability Based Investments	**149,117**	**149,117**	**154,220**	**+5,103**	**+3.4%**
Planning for Programmatic Construction (Pre-CD-1)	**10,000**	**10,000**	**0**	-10,000	-100.0%
Total, Production Modernization	**3,903,533**	**3,903,533**	**4,640,594**	**+737,061**	**+18.9%**
Stockpile Research, Technology, and Engineering					
Assessment Science					
Primary Assessment Technologies	150,000	150,000	154,507	+4,507	+3.0%
Dynamic Materials Properties	130,981	130,981	124,366	-6,615	-5.1%
Advanced Diagnostics	35,989	35,989	31,064	-4,925	-13.7%
Secondary Assessment Technologies	84,000	84,000	72,104	-11,896	-14.2%
Enhanced Capabilities for Subcritical Experiments	215,579	215,579	277,225	+61,646	+28.6%
Hydrodynamic and Subcritical Experiment Execution Support	152,845	152,845	142,402	-10,443	-6.8%
17-D-640, U1a, Complex Enhancements Project, NNSS	160,600	160,600	53,130	-107,470	-66.9%
Total, Assessmment Science	**929,994**	**929,994**	**854,798**	**-75,196**	**-8.1%**
Engineering and Integrated Assessments					
Archiving and Support	45,760	45,760	43,950	-1,810	-4.0%
Delivery Environments	39,235	39,235	37,674	-1,561	-4.0%
Weapons Survivability	59,500	59,500	93,303	+33,803	+56.8%
Studies and Assessments	0	0	5,000	+5,000	0%
Aging and Lifetimes	62,260	62,260	59,682	-2,578	-4.1%
Stockpile Responsiveness	70,000	70,000	68,742	-1,258	-1.8%
Advanced Certification and Qualification	60,649	60,649	58,104	-2,545	-4.2%
Total, Engineering and Integrated Assessments	**337,404**	**337,404**	**366,455**	**+29,051**	**+8.6%**
Inertial Confinement Fusion	**575,000**	**575,000**	**544,095**	**-30,905**	**-5.4%**
Advanced Simulation and Computing	**761,214**	**761,214**	**742,646**	**-18,568**	**-2.4%**

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Weapon Technology and Manufacturing Maturation					
Surety Technologies	54,365	54,365	51,497	-2,868	-5.3%
Weapon Technology Development	131,692	131,692	121,330	-10,362	-7.9%
Advanced Manufacturing Development	111,908	111,908	113,338	+1,430	+1.3%
Total, Weapon Technology and Manufacturing Maturation	**297,965**	**297,965**	**286,165**	**-11,800**	**-4.0%**
Academic Programs	**101,912**	**101,912**	**100,499**	-1,413	-1.4%
Total, Stockpile Research, Technology, and Engineering	**3,003,489**	**3,003,489**	**2,894,658**	**-108,831**	**-3.6%**
Infrastructure and Operations					
Operating					
Operations of Facilities	**1,014,000**	**1,014,000**	**1,038,000**	+24,000	+2.4%
Safety and Environmental Operations	**165,354**	**165,354**	**162,000**	-3,354	-2.0%
Maintenance and Repair of Facilities	**667,000**	**667,000**	**680,000**	+13,000	+1.9%
Recapitalization					
Infrastructure and Safety	573,717	573,717	561,663	-12,054	-2.1%
Subtotal, Recapitalization	**573,717**	**573,717**	**561,663**	**-12,054**	**-2.1%**
Total, Operating	**2,420,071**	**2,420,071**	**2,441,663**	**+21,592**	**+0.9%**
Construction					
Mission Enabling Construction					
23-D-519 Special Materials Facility, Y-12	0	0	49,500	+49,500	0%
23-D-518 Plutonium Modernization Operations & Waste Management Office Building, LANL	0	0	48,500	+48,500	0%
23-D-517 Electrical Power Capacity Upgrade, LANL	0	0	24,000	+24,000	0%
22-D-514 Digital Infrastructure Capability Expansion, LLNL	0	0	67,300	+67,300	0%
19-D-670 138kV Power Transmission System Replacement, NNSS	59,000	59,000	0	-59,000	-100%
15-D-612 Emergency Operations Center, LLNL	27,000	27,000	0	-27,000	-100.0%
15-D-611 Emergency Operations Center, SNL	36,000	36,000	0	-36,000	-100.0%
Total, Mission Enabling Construction	**122,000**	**122,000**	**189,300**	**+67,300**	**+55.2%**
Total, Infrastructure and Operations	**2,542,071**	**2,542,071**	**2,630,963**	**+88,892**	**+3.5%**

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Secure Transportation Asset					
Operations and Equipment	**225,000**	**225,000**	**214,367**	**-10,633**	**-4.7%**
Program Direction	**123,684**	**123,684**	**130,070**	**+6,386**	**+5.2%**
Total, Secure Transportation Asset	**348,684**	**348,684**	**344,437**	**-4,247**	**-1.2%**
Defense Nuclear Security					
Operations and Maintenance	**763,078**	**763,078**	**878,363**	**+115,285**	**+15.1%**
Construction	**26,000**	**26,000**	**3,928**	**-22,072**	**-84.9%**
Total, Defense Nuclear Security	**789,078**	**789,078**	**882,291**	**+93,213**	**+11.8%**
Information Technology and Cybersecurity	**366,233**	**366,233**	**445,654**	**+79,421**	**+21.7%**
Legacy Contractor Pensions and Settlement Payments	**101,668**	**101,668**	**114,632**	**+12,964**	**+12.8%**
Subtotal, Weapons Activities	**15,345,000**	**15,345,000**	**16,882,302**	**+1,537,302**	**+10.0%**
Use of Prior Year Balances	0	0	-396,004	-396,004	0%
Total, Weapons Activities	**15,345,000**	**15,345,000**	**16,486,298**	**+1,141,298**	**+7.4%**

Weapons Activities
Outyear Funding

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Weapons Activities Appropriation				
Stockpile Management				
B61-12 LEP	501,744	242,424	12,892	0
W88 ALT 370	148,823	78,700	17,700	0
W80-4 LEP	1,009,929	1,009,929	966,090	808,900
W80-4 ALT-SLCM	0	0	0	0
W87-1 Modification Program	797,377	880,908	920,000	1,002,724
W93 Program	323,000	471,372	625,000	814,000
Future Strategic Warhead	0	0	0	70,000
Total, Stockpile Major Modernization	**2,780,873**	**2,683,333**	**2,541,682**	**2,695,624**
Stockpile Sustainment	**1,435,630**	**1,470,402**	**1,448,471**	**1,408,401**
Weapons Dismantlement and Disposition	**51,000**	**51,380**	**52,459**	**53,561**
Production Operations	**644,443**	**668,530**	**674,572**	**690,007**
Nuclear Enterprise Assurance	**55,229**	**69,816**	**61,389**	**66,658**
Total, Stockpile Management	**4,967,175**	**4,943,461**	**4,778,573**	**4,914,251**
Production Modernization				
Primary Capability Modernization				
Plutonium Modernization				
Los Alamos Plutonium Modernization				
Los Alamos Plutonium Operations	814,507	820,898	873,846	906,943
21-D-512 Plutonium Pit Production Project, LANL	670,000	660,000	625,000	365,000
15-D-302 TA-55 Reinvestments Project, Phase 3, LANL	30,000	34,475	2,000	0
07-D-220-04 Transuranic Liquid Waste Facility, LANL	8,933	0	0	0
04-D-125 Chemistry and Metallurgy Research Replacement Project, LANL	248,917	167,867	0	0
Total, Los Alamos Plutonium Modernization	**1,772,357**	**1,683,240**	**1,500,846**	**1,271,943**

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Savannah River Plutonium Modernization				
Savannah River Plutonium Operations	70,000	81,584	120,000	170,000
21-D-511 Savannah River Plutonium Processing Facility, SRS	858,235	1,014,508	1,051,339	952,000
Total, Savannah River Plutonium Modernization	**928,235**	**1,096,092**	**1,171,339**	**1,122,000**
Enterprise Plutonium Support	87,948	94,766	90,365	91,317
Total, Plutonium Modernization	**2,788,540**	**2,874,098**	**2,762,550**	**2,485,260**
High Explosives & Energetics				
High Explosives & Energetics	95,497	85,675	89,747	91,632
23-D-516 Energetic Materials Characterization Facility, LANL	29,000	107,000	136,000	43,000
21-D-510 HE Synthesis, Formulation, and Production, PX	162,000	212,000	96,767	0
15-D-301 HE Science & Engineering Facility, PX	58,356	0	0	0
Total, High Explosives & Energetics	**344,853**	**404,675**	**322,514**	**134,632**
Total, Primary Capability Modernization	**3,133,393**	**3,278,773**	**3,085,064**	**2,619,892**
Secondary Capability Modernization				
Uranium Modernization	372,508	332,534	330,126	337,059
Depleted Uranium Modernization	195,600	197,000	181,000	173,000
Lithium Modernization	44,833	45,820	46,828	47,811
18-D-690 Lithium Processing Facility, Y-12	260,770	280,000	290,000	250,000
06-D-141 Uranium Processing Facility, Y-12	122,589	0	0	0
Total, Secondary Capability Modernization	**996,300**	**855,354**	**847,954**	**807,870**
Tritium and Domestic Uranium Enrichment				
Tritium Sustainment and Modernization	339,173	365,350	352,602	360,007
Domestic Uranium Enrichment	233,262	273,869	307,214	314,355
Uranium Reserve	0	0	0	0
18-D-650 Tritium Finishing Facility, SRS	92,200	105,700	89,200	66,200
Total, Tritium and Domestic Uranium Enrichment	**664,635**	**744,919**	**749,016**	**740,562**

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Non-Nuclear Capability Modernization				
Non-Nuclear Capability Modernization	168,278	141,694	121,566	122,529
22-D-513, Power Sources Capability, SNL	37,886	71,083	43,902	44,824
Total, Non-Nuclear Capability Modernization	**206,164**	**212,777**	**165,468**	**167,353**
Capability Based Investments	**157,071**	**153,597**	**154,658**	**161,896**
Planning for Programmatic Construction (Pre-CD-1)	**0**	**0**	**0**	**0**
Warhead Assembly				
Warhead Assembly Operations	0	0	10,000	15,000
18-D-680, Material Staging Facility, PX	0	0	15,000	100,000
Total, Warhead Assembly	**0**	**0**	**25,000**	**115,000**
Total, Production Modernization	**5,157,563**	**5,245,420**	**5,027,160**	**4,612,573**
Stockpile Research, Technology, and Engineering				
Assessment Science				
Primary Assessment Technologies	160,905	171,138	170,614	173,767
Dynamic Materials Properties	128,777	131,482	134,243	137,062
Advanced Diagnostics	35,200	36,500	33,210	33,907
Secondary Assessment Technologies	75,006	76,581	78,273	79,917
Enhanced Capabilities for Subcritical Experiments	272,300	180,000	115,256	113,604
Hydrodynamic and Subcritical Experiment Execution Support	146,410	148,443	148,245	151,358
17-D-640, U1a, Complex Enhancements Project, NNSS	129,870	0	0	0
Total, Assessmment Science	**948,468**	**744,144**	**679,841**	**689,615**
Engineering and Integrated Assessments				
Archiving & Support	44,881	44,875	44,819	45,769
Delivery Environments	38,453	38,447	38,397	39,208
Weapons Survivability	88,517	59,002	39,248	43,434
Studies and Assessments	5,000	5,000	5,000	5,105
Aging & Lifetimes	60,781	60,813	60,742	62,035
Stockpile Responsiveness	70,000	70,000	70,000	71,470
Advanced Certification & Qualification	59,234	59,229	59,160	60,417
25-D-XXX, Combined Radiation Effects Survivability Testing, SNL	0	97,000	164,000	212,000
Total, Engineering and Integrated Assessments	**366,866**	**434,366**	**481,366**	**539,438**

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Inertial Confinement Fusion	**549,701**	**549,701**	**549,701**	**561,245**
Advanced Simulation and Computing	**753,794**	**753,795**	**753,795**	**769,415**
Weapon Technology and Manufacturing Maturation				
Surety Technologies	50,446	51,619	51,619	52,703
Weapon Technology Development	150,468	153,333	138,323	130,072
Advanced Manufacturing Development	144,524	146,196	131,196	123,741
Total, Weapon Technology and Manufacturing Maturation	**345,438**	**351,148**	**321,138**	**306,516**
Academic Programs	**102,526**	**104,576**	**106,667**	**108,801**
Total, Stockpile Research, Technology, and Engineering	**3,066,793**	**2,937,730**	**2,892,508**	**2,975,030**
Infrastructure and Operations				
Operating				
Operations of Facilities	1,144,000	1,182,000	1,222,000	1,250,000
Safety and Environmental Operations	161,000	167,000	167,000	171,000
Maintenance and Repair of Facilities	711,000	727,000	743,000	751,000
Recapitalization				
Infrastructure and Safety	580,470	582,220	604,204	666,428
Subtotal, Recapitalization	**580,470**	**582,220**	**604,204**	**666,428**
Total, Operating	**2,596,470**	**2,658,220**	**2,736,204**	**2,838,428**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
	(Dollars in Thousands)			
Construction				
Mission Enabling Construction				
27-D-XXX, Plutonium Engineering Support Building, LANL	0	0	0	48,700
26-D-XXX, U1a Complex Access Shaft, NNSS	0	0	30,000	85,000
26-D-XXX, Plutonium Program Accounting Building, LANL	0	0	48,700	0
25-D-XXX, Plutonium Mission Safety & Quality Building, LANL	0	48,500	0	0
25 D- XXX, Maintenance Facility, Y-12	0	50,000	0	0
24-D-XXX, Analytic Gas Laboratory, PX	35,000	0	0	0
24-D-XXX, Plutonium Production Building, LANL	48,500	0	0	0
23-D-519, Special Materials Facility, Y-12	0	0	0	0
23-D-518, Plutonium Modernization Operations & Waste Management Office Building, LANL	0	0	0	0
23-D-517, Electrical Power Capacity Upgrade, LANL	95,000	86,000	79,000	0
22-D-514, Digital Infrastructure Capability Expansion, LLNL	0	0	0	0
19-D-670, 138kV Power Transmission System Replacement, NNSS	0	0	0	0
16-D-515, Albuquerque Complex Project	0	0	0	0
15-D-612, Emergency Operations Center, LLNL	0	0	0	0
15-D-611, Emergency Operations Center, SNL	0	0	0	0
Total, Mission Enabling Construction	**178,500**	**184,500**	**157,700**	**133,700**
Total, Infrastructure and Operations	**2,774,970**	**2,842,720**	**2,893,904**	**2,972,128**

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Secure Transportation Asset				
Operations and Equipment	222,412	245,709	250,873	301,145
Program Direction	132,264	135,264	138,100	140,996
Total, Secure Transportation Asset	**354,676**	**380,973**	**388,973**	**442,141**
Defense Nuclear Security				
Operations and Maintenance	927,563	955,314	991,527	1,049,188
Construction	0	0	0	0
Total, Defense Nuclear Security	**927,563**	**955,314**	**991,527**	**1,049,188**
Information Technology and Cybersecurity	494,124	513,889	534,445	587,200
Legacy Contractor Pensions and Settlement Payments	73,452	77,578	79,206	80,869
Subtotal, Weapons Activities	**17,816,316**	**17,897,085**	**17,586,296**	**17,633,380**
Use of Prior Year Balances	0	0	0	0
Total, Weapons Activities	**17,816,316**	**17,897,085**	**17,586,296**	**17,633,380**

Research and Development

The Office of Management and Budget (OMB) Circular No A-11, "Preparation, Submission, and Execution of the Budget," requires the reporting of research and development (R&D) data consistent with this requirement, R&D activities funded by NNSA Weapons Activities programs are displayed below.

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Research and Development (R&D)					
Basic				0	0%
Applied	2,983,546	3,086,697	3,180,281	+196,735	6.6%
Development	496,959	506,424	636,891	+139,932	28.2%
Subtotal, R&D	**3,480,505**	**3,593,121**	**3,817,172**	**+336,667**	**9.7%**
Equipment	547,840	437,717	396,820	-151,020	-27.6%
Construction	244,552	244,493	82,797	-161,756	-66.1%
Total, R&D	**4,272,898**	**4,275,331**	**4,296,789**	**+23,891**	**0.6%**

Stockpile Management

Overview
The Stockpile Management program requirements for FY 2023 maintain a safe, secure, and effective nuclear weapons stockpile. The Stockpile Management program encompasses five major subprograms that directly support the nation's nuclear weapons stockpile. **Stockpile Major Modernization** will continue Phase 6.6 (Full-Scale Production) activities for the B61-12 LEP and W88 ALT 370; continue Phase 6.4 (Production Engineering) activities for the W80-4 LEP; continue Phase 6.3 (Development Engineering) activities for the W87-1 Modification Program; and continue Phase 2 (Feasibility Study and Design Options) for the W93 Program. **Stockpile Sustainment** will provide activities to include maintenance, limited life component exchanges, minor alterations, surveillance, assessment, surety studies and capability development, and management activities for each Stockpile System and Multi-Weapon Systems and will continue Phase 6.3 (Development Engineering) activities for the W76-1/2 Mk4B. **Weapons Dismantlement and Disposition (WDD)** will provide safe and secure dismantlement of nuclear weapons and components in accordance with the Nuclear Weapons Stockpile Plan, and **Production Operations (PO)** will sustain manufacturing capabilities and capacities, including process improvements and investments focused on increased efficiency of production performance. FY 2023 includes a new Stockpile Management subprogram **Nuclear Enterprise Assurance (NEA)** formulated to prevent, detect, and mitigate potential consequences of subversion to the stockpile and associated capabilities to design, produce, and test nuclear weapons.

Major Subprogram Overview:

Stockpile Major Modernization extends the lifetime of the nation's nuclear stockpile while addressing required updates, replacing aging or obsolete components to ensure continued service life, as well as enhancing security and safety features.

Stockpile Sustainment directly executes maintenance, limited life component exchanges, minor alterations, surveillance, assessment, surety studies and capability development, and management activities for all enduring weapons systems in the stockpile. The program includes the B61, W76, W78, W80, B83, W87 and W88 Stockpile Systems, as well as Multi-Weapon Systems (MWS).

Weapons Dismantlement and Disposition (WDD) provides weapon dismantlements, safety studies on retired systems, material characterization, legacy component disposition, and the disposal of retired weapon parts. Includes activities for technical analysis needed to dismantle and safely store weapons being removed from the stockpile.

Production Operations (PO) is a multi-weapon system manufacturing-based program that drives individual site production capabilities and capacity for the stockpile sustainment and modernization programs, including limited life component production and weapon assembly and disassembly operations. Production Operations also provides programmatic equipment maintenance, and maintenance/calibration services for manufacturing operations to meet DOD War Reserve requirements. Production Operations scope covers sustainment of labor required for weapon systems capabilities that enable individual weapon production and are not specific to one material stream. Facility major modernization and construction activities are not part of this budget subprogram and are covered in other parts of the Weapons Activities account.

Nuclear Enterprise Assurance (NEA) ensures the Nuclear Security Enterprise (NSE) actively manages subversion risks to the nuclear weapons stockpile and associated design, production, and testing capabilities. Digital technologies introduce new vulnerability characteristics and multiple new susceptible pathways that if compromised can produce unacceptable physical impacts to safety, the environment, weapon performance, and loss of capabilities. Through nuclear weapon digital assurance (NWDA), NEA enables risk-managed adoption of leading-edge technologies to meet emerging military requirements and reduce modernization schedules and costs. NEA maintains a team of multi-disciplinary experts who perform rapid assessments, develop tools and assurance methods, and provide recommended mitigations. Close coordination is maintained across NNSA and other agencies to stay informed of current threats and best practices.

Stockpile Management
Funding

	(Dollars in Thousands)				
	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Stockpile Management					
Stockpile Management					
Stockpile Major Modernization					
B61-12 LEP	815,710	815,710	672,019	-143,691	-17.6%
W88 ALT 370	256,922	256,922	162,057	-94,865	-36.9%
W80-4 LEP	1,000,314	1,000,314	1,122,451	+122,137	+12.2%
W80-4 ALT-SLCM	0	0	0	0	0%
W87-1 Modification Program	541,000	541,000	680,127	+139,127	+25.7%
W93 Program	53,000	53,000	240,509	+187,509	+353.8%
Total, Stockpile Major Modernization	**2,666,946**	**2,666,946**	**2,877,163**	**+210,217**	**+7.9%**
Stockpile Sustainment	**998,357**	**998,357**	**1,321,139**	**+322,782**	**+32.3%**
Weapons Dismantlement and Disposition	**56,000**	**56,000**	**50,966**	**-5,034**	**-9.0%**
Production Operations	**568,941**	**568,941**	**630,894**	**+61,953**	**+10.9%**
Nuclear Enterprise Assurance	**0**	**0**	**48,911**	**+48,911**	**0%**
Total, Stockpile Management	**4,290,244**	**4,290,244**	**4,929,073**	**+638,829**	**+14.9%**

Stockpile Management
Outyear Funding

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Stockpile Management				
Stockpile Major Modernization				
B61-12 LEP	501,744	242,424	12,892	0
W88 ALT 370	148,823	78,700	17,700	0
W80-4 LEP	1,009,929	1,009,929	966,090	808,900
W80-4 ALT-SLCM	0	0	0	0
W87-1 Modification Program	797,377	880,908	920,000	1,002,724
W93 Program	323,000	471,372	625,000	814,000
Future Strategic Warhead	0	0	0	70,000
Total, Stockpile Major Modernization	**2,780,873**	**2,683,333**	**2,541,682**	**2,695,624**
Stockpile Sustainment	**1,435,630**	**1,470,402**	**1,448,471**	**1,408,401**
Weapons Dismantlement and Disposition	**51,000**	**51,380**	**52,459**	**53,561**
Production Operations	**644,443**	**668,530**	**674,572**	**690,007**
Nuclear Enterprise Assurance	**55,229**	**69,816**	**61,389**	**66,658**
Total, Stockpile Management	**4,967,175**	**4,943,461**	**4,778,573**	**4,914,251**

Stockpile Management
Explanation of Major Changes
(Dollars in Thousands)

	FY 2023 Request vs FY 2021 Enacted ($)
Stockpile Management	
Stockpile Major Modernization: The increase represents the W80-4 LEP ramp-up for entrance to Phase 6.4 (Production Engineering) including readiness activities; the W87-1 Modification Program transition from Phase 6.2 (Feasibility Study and Design Options), to Phase 6.3 (Development Engineering); and the W93 Program continued planned ramp-up for Phase 2 (Feasibility Study and Design Option) activities.	**+210,217**
Stockpile Sustainment: The increase primarily represents W76 Mk4B development and qualification; design, development, qualification, and production of weapon surety capabilities; implementation of Integrated Surety Architecture (ISA) in accordance with the FY 2018 National Defense Authorization Act (NDAA); development and deployment of product realization and digital engineering tools and applications; transition of the B61-12 into the stockpile; high explosive component development and production; special material procurement supporting limited life components (LLCs); Joint Test Assembly (JTA) flight test vehicle development and production; and activities supporting transition from Minuteman III (MMIII) to Air Force Sentinel, also known as the Ground Based Strategic Deterrent (GBSD).	**+322,782**
Weapons Dismantlement and Disposition: The decrease represents a reduction in disposition of legacy component inventories.	**-5,034**
Production Operations: The increase represents programmatic equipment maintenance scope for SNL and KCNSC transferred from the Infrastructure and Operations portfolio; KCNSC expansion and equipment relocation; and hiring of critical skilled labor resources to support increase in production activities.	**+61,953**
Nuclear Enterprise Assurance: The increase represents the establishment of a new Stockpile Management subprogram to actively manage subversion risks to the nuclear weapons stockpile and associated design, production, and testing capabilities.	**+48,911**
Total, Stockpile Management	**+638,829**

Stockpile Management
Stockpile Major Modernization

Overview

The Stockpile Major Modernization program extends the lifetime of the nation's nuclear stockpile while addressing required updates, replacing aging/obsolete components to ensure continued service life, and enhancing security and safety features. Stockpile Major Modernization is the stockpile management subprogram necessary to address updated DOD requirements for potentially new capabilities or extending the expected life of stockpile systems for an additional 20 to 30 years. NNSA, in conjunction with DOD, executes stockpile modernization following the Phase X/6.X process guidelines, which provides a framework to conduct and manage refurbishment activities for potentially new or existing weapons, respectively. Phase 1/6.1 (Concept Assessment) should provide sufficient information for the Nuclear Weapons Council (NWC) to authorize Phase 2/6.2 (Feasibility Study and Design Options). Follow-on phases include Phase 2A/6.2A (Design Definition and Cost Study), Phase 3/6.3 (Development Engineering), Phase 4/6.4 (Production Engineering), Phase 5/6.5 (First Production) and Phase 6/6.6 (Full-Scale Production). For the purposes of this justification, the term "refurbishment" refers to all nuclear weapon alterations and modifications, including LEPs, modernization, and revised military requirements.

Stockpile Management
Stockpile Major Modernization

Description

B61-12 LEP

The B61-12 LEP refurbishes, reuses, or replaces all 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. This life extension program addresses all age-related issues of the bomb, and enhances its reliability, field maintenance, safety, and Use Control. With these upgrades and the addition of an Air Force supplied Tail Kit Assembly, the B61-12 LEP will consolidate and replace three B61 weapon designs: 3, 4, and 7. When fielded, the B61-12 will balance greater accuracy provided by the modern tail kit, with no overall change in military characteristics. In June 2016, NNSA authorized the program to transition into Phase 6.4 (Production Engineering). In 2019, delivery of the system-level First Production Unit (FPU) was formally rescheduled due to delays resulting from an issue with capacitors used in six major electrical components. At the gate review in September 2020 with a follow-on memorandum in November 2020, NNSA authorized the program to transition into Phase 6.5 (First Production) and the Air Force conducted Final Design Review and Acceptance Group (FDRAAG). In FY 2022, NNSA achieved system level FPU at the Pantex Plant and is scheduled to enter Phase 6.6 (Full-Scale Production) in Q3 FY 2022. Program completion is planned for FY 2026.

W88 ALT 370

The W88 ALT 370 Program increases the W88 lifetime by modernizing the arming, fuzing, and firing (AF&F) assembly; improving surety; and incorporating a lightning arrestor connector. It also provides required logistical spares for sustaining the life of the system. During development, the arming and fuzing portion of the AF&F assembly was designed to be forward compatible with Air Force Fuze requirements, maintaining joint capability during production. The maintenance programs for neutron generator (NG) and gas transfer system (GTS) replacement receive funding under the W88 enduring stockpile system, and as required, while Limited Life Component (LLC) replacement will be performed concurrently with the ALT 370 conversion. In November 2014, the NWC authorized replacement of the Conventional High Explosive (CHE) and associated materials on the W88 coincident with ALT 370 activities, referred to as CHE Refresh. The CHE Refresh scope is included in the W88 ALT 370 Program and leverages existing tests to the maximum extent possible to minimize costs and reduce logistical impacts to the Navy. In February 2017, NNSA authorized the program to transition into Phase 6.4 (Production Engineering). In 2019, delivery of the reentry body assembly was formally rescheduled because of delays resulting from an issue with capacitors used in three major components. Phase 6.5 (First Production) authorization occurred in November 2020, and NNSA completed the reentry body assembly FPU in July 2021. The NWC formally accepted the W88 ALT 370 as a standard stockpile item in December 2021. The program completion date is planned for FY 2026.

W80-4 LEP

The W80-4 LEP extends the life of the legacy W80 warhead for use in the Air Force Long Range Stand-Off (LRSO) cruise missile. The LRSO is the replacement for the current, aging Air-Launched Cruise Missile (ALCM). The life extension program will integrate the warhead with the replacement missile platform and address warhead component aging concerns as well as military requirements for reliability, service life, field maintenance, and surety. The program established key design requirements for this LEP include using insensitive high explosives for the primary, enhancing surety, and developing the warhead/missile interface in parallel with the Air Force. In July 2015, the NWC authorized the program to transition into Phase 6.2, Feasibility Study and Option down-select. The program received Phase 6.2A (Design Definition and Cost Study) authorization on September 28, 2017, and the NNSA team continued to work closely with the LRSO missile development team and contractors to refine the design. The program completed the primary 6.2A deliverable, the W80-4 LEP Weapon Design and Cost Report (WDCR), in FY 2019.

The NWC approved the W80-4 LEP transition to Phase 6.3, Development Engineering, in February 2019 in support of the Air Force LRSO missile program. The next major milestone is System Baseline Design Review (BDR) and entry into Phase 6.4, Production Engineering in FY2023. After this review the Program will update its bottom-up cost and schedule estimates and enter Phase 6.4, Production Engineering.

Per direction from the NWC, the W80-4 Program of Record includes a 2025 FPU. However, that date is currently being re-evaluated due to COVID, staffing and technical progress delays. Due to the current margin between NNSA FPU and Air Force Initial Operational Capability (IOC), NNSA has high confidence that it will support Air Force LRSO weapon IOC in FY 2030.

W80-4 ALT-SLCM

Consistent with the Administration's Nuclear Posture Review, NNSA did not request funding for this program.

W87-1 Modification Program

The W87-1 Modification Program will replace the W78 warhead and support fielding on the Air Force Sentinel, also known as Ground Based Strategic Deterrent (GBSD) missile system by FY 2030. The W78 is one of the oldest warheads in the stockpile and the W87-1 Modification Program provides improvement in warhead security, safety, and Use Control. The W87-1 Modification Program is based on a modified design of the W87-0 and will be fielded in the Mk21A reentry vehicle. The FPU is planned for FY 2030.

W93 Program

The W93 Program modernization activity will use the joint NNSA-DOD Phase 1-7 weapons acquisition process that is similar to the Phase 6.X process. Work in support of the W93 Program includes Phase 1 (Concept Assessment) to evaluate warhead architectures and available technologies against potential range of desired attributes, draft military characteristics, and known constraints. It also informs the DOD's program activities to define the requirements for the associated Mk7 reentry body within which the W93 Program will be deployed. Deliverables also include documenting the results of the Concept Assessment study, providing recommendations for scope of feasibility study and design options for Phase 2 (Feasibility Study and Design Options), and beginning execution for Phase 2 (Feasibility Study and Design Options). The UK is participating as observers in the US W93/Mk7 warhead program.

Highlights of the FY 2023 Budget Request

B61-12 LEP

- Execute steady state production of all components.
- Maintain system-level production at Pantex Plant and deliver B61-12 weapons to the DOD in support delivery dates.
- Execute aircraft compatibility testing, including the Air Force B-21 Raider and Dual Capable Aircraft (U.S. and NATO).
- Execute Retrofit Evaluation System Test (REST) surveillance scope for both system and component in-flight and lab environments.

W88 ALT 370

- Execute full-scale system-level production.
- Complete first production unit of the Alternate Main Charge B High Explosive and complete CET-5 flight test.

W80-4 LEP

- Begin Phase 6.4 (Production Engineering) activities for the W80-4 LEP in support of the Air Force LRSO program.
- Begin Component Final Design Reviews.
- Complete Component Product Definition and Documentation Reviews.
- Continue Facility Upgrade Minor Construction project and Major Item of Equipment for the Fulmer project.
- Develop Preliminary Weapon Development Report.
- Conduct joint testing with Air Force Long Range Stand-Off (LRSO) Program including Missile Development Flight Testing.

W87-1 Modification Program

- Mature program management and program controls and transition to oversight of the W87-1 Modification Program with Earned Value Management.
- Advance technology maturation and manufacturing readiness levels.
- Conduct qualitative risk identification and impact analysis and mature quantitative risk analysis process.
- Conduct joint testing with Air Force Ground Based Strategic Deterrence (GBSD) and Mk21A programs, including preparations for the first W87-1 flight test with a GBSD missile.

- Continue Phase 6.3 (Development Engineering) and advance technology and manufacturing readiness levels, and progress component and sub-system designs in preparation for the system conceptual design review.

W93 Program
- Continue Phase 2 (Feasibility Study and Design Options), with NWC approval, to ascertain and down-select major subsystem designs and components.
- Conduct customer requirements reviews with the Navy and begin requirements assignment to lower-level systems and major components.
- Continue to establish federal program management documents including a mature Work Breakdown Structure to serve as the basis for the Phase 2A (Design Definition and Cost Study) and Weapon Design Cost Report (WDCR) for eventual entry into Phase 3 (Development Engineering).
- Assess technology and Manufacturing Readiness Levels for potential feasible designs.
- Generate M&O technical documents as part of Phase 2 (Feasibility Study and Design Options) study and design options.
- Coordinate with the UK on their Replacement Warhead.

FY 2024 – FY 2027 Key Milestones
B61-12 LEP
- Complete B61-12 shipments to the Air Force and achieve Full Operational Capability.
- Complete Pantex Last Production Unit and life of program component overbuilds by FY 2026.
- Execute aircraft integration activities with U.S. Air Force B-21 bomber and Dual Capable Aircraft throughout FY 2024- FY 2025.
- Complete Retrofit Evaluation System Test (REST) System and Component level flight and laboratory testing by FY 2025.
- Complete program closeout by FY 2026.

W88 ALT 370
- Maintain component and system-level steady state production rates from FY 2024 to FY 2026.
- Complete W88 ALT 370 system conversions (last production unit) by FY 2026.
- Conduct program closeout activities in FY 2026.

W80-4 LEP
- Complete System Final Design Review in FY 2024.
- Conduct System/Warhead A/D Pre-Pilot Production Gate in FY 2024.
- Receive Phase 6.5 (First Production) Authorization in FY 2025.
- Produce First Production Unit (FPU) in FY 2025.
- Conduct System and Warhead Production Steady State Gate in FY 2026.
- Receive Phase 6.6 (Full-Scale Production Authorization) in FY 2026.

W87-1 Modification Program
- Conduct, in conjunction with the Air Force, GBSD environmental flight tests in Mk21A in FY 2024 and FY 2025.
- Complete Component Baseline Design Reviews in FY 2024 and FY 2025.
- Complete System Baseline Design Review in FY 2025.
- Complete Baseline Cost Report in FY 2026.
- Enter Phase 6.4 (Production Engineering) in FY 2026.
- Conduct, in conjunction with the Air Force, W87-1 JTA development flight tests in FY 2026 and FY 2027.

W93 Program
- Complete W93 Program Phase 2 (Feasibility Study and Design Options).
- Complete Phase 2A (Design Definition and Cost Study), in FY 2025/2026 including the Weapon Design and Cost Report (WDCR).
- Obtain Phase 3 (Development Engineering) authorization from the NWC.

Future Strategic Warhead

- Execute in FY 2027 the Phase 6.1 (Concept Assessment) for the Future Strategic Warhead (FSW) culminating in a Phase 6.2 (Feasibility Study and Design Options) recommendation briefing to the NWC.

FY 2021 Accomplishments

B61-12 LEP

- Achieved FPU on 115 of 115 weapon components including all six Base Metal Electrode (BME) capacitor affected components.
- Completed seven system joint flight tests on PA-200, F-16 Mid-Life Upgrade (MLU), and F-35A aircraft platforms.
- Completed all system level electrical and electromagnetic testing required because of the six capacitor affected components, verifying the B61-12 meets military requirements.
- Completed all four First Production Capability Units (FPCU) activities at Pantex, including two Weapons Evaluation Test Laboratory (WETL) system level testing and two Development Joint Test Assembly (DJTA) builds.

W88 ALT 370

- Received authorization to enter Phase 6.5 (First Production).
- Completed all qualification activities and FPUs for components affected by the capacitor issue.
- Completed System FPU in July 2021.
- Completed Joint Test Assembly 8 FPU in September 2021.

W80-4 LEP

- Completed Program Protection Plan (PPP).
- Completed Nuclear Explosive Package (NEP) Certification Plan.
- Completed Nuclear Weapon Subsystem Test Plan (NWSSTP).
- Kicked off Baseline Cost Report development in March 2021.
- Kicked off Preliminary Design Review and Acceptance Group in August 2021.
- Conducted joint testing with Air Force Long Range Stand-Off (LRSO) weapon:
  - Completed successful Environmental Test Unit (ETU) 1: Instrumented Captive Carriage (ICC) 4 test
  - Completed ETU3-501 delivery for Separation and Control Test Vehicle (SCTV)-2
  - Delivered Functional Ground Test Unit (FGTU)-501 for the Functional Ground Test Vehicle (FGTV)-1 test

W87-1 Modification Program

- Finalized and documented W87-1 down-select decisions.
- Documented W87-1 component design trades.
- Completed initial design definition discussions between the Design Agencies and Production Agencies.
- Conducted several life-of-program material procurements.
- Formalized W87-1/Mk21A Memorandum of Understanding with the Air Force.
- Completed Customer Requirements Review with the Air Force.
- Continued coordinated flight test requirements with the Air Force.
- Completed down-select to single warhead architecture.
- Entered Phase 6.2A (Design Definition and Cost Study).

W93 Program

- Identified nuclear and non-nuclear design space.
- Prepared Class 5 Cost Estimates.
- Conducted Technology Readiness Assessment.
- Initiated Phase 1 (Concept Assessment) study report.

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
B61-12 LEP $815,710,000	**B61-12 LEP $672,019,000**	**B61-12 LEP -$143,691,000**
• Executed aircraft compatibility testing with dual capable aircraft (U.S. and NATO), including the Air Force F-35A and B-21. • Executed steady state component production on all components unaffected by capacitor issue. • Achieved First Production for capacitor affected components and begin shipments to Pantex. • Completed system validation testing for capacitor affect components. • Completed two remaining FPCUs.	• Maintain component full-scale production. • Execute system level builds at Pantex Plant and B61-12 shipment schedules to DOD. • Execute aircraft compatibility testing with bombers and dual capable aircraft (U.S. and NATO), including the Air Force B-21.	• The decrease represents alignment with the program plan to execute full-scale production. The Design Agencies will complete FY 2023 activities. Production of components will be at full rate.
W88 ALT 370 $256,922,000	**W88 ALT 370 $162,057,000**	**W88 ALT 370 -$94,865,000**
• Completed FPU for the reentry body assembly and JTA8 Test Body and ramp-up to full-scale production. • Executed full-scale production of all components not affected by the capacitor issue supporting original delivery schedules. • Completed qualification activities for components affected by the capacitor issue and executed full-scale production. • Completed all System Qualification tests, including those added due to the capacitor issue.	• Execute Phase 6.6 (Full-Scale Production) in accordance with approved schedules. • Continue coordinating closely with the Navy to ensure a fully integrated schedule of hardware needs and deliveries.	• The decrease represents start of Phase 6.6 (Full-Scale Production) and a significant decrease in design activity.
W80-4 LEP $1,000,314,000	**W80-4 LEP $1,122,451,000**	**W80-4 LEP +$122,137,000**
• Continued Phase 6.3 (Development and Engineering) activities as staffing levels ramp-up which is consistent with the increase in PPI and QE builds and testing activities. • Commencement of Baseline Cost Report Update/Independent Cost Estimate for 6.4	• Begin Phase 6.4 (Production Engineering) activities for the W80-4 in support of the Air Force LRSO program. • Complete Product Definition and Documentation Review. • Release System Complete Engineering.	• The increase represents a ramp-up of activities as the program transitions from Phase 6.3 (Development Engineering) to Phase 6.4 (Production Engineering).

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Authorization. • Completed Component Baseline Design Reviews and Product Pre-Production Engineering Gates. Associated testing and analysis continued to increase with a focus on progressing Technology and Manufacturing Readiness Levels and transitioning towards 6.4 Authorization and Production Engineering. • Continued Warhead simulators/test unit deliveries. as the W80-4 LEP integrates with Cruise Missile contractor. • Continued fit Check Units and Separation Control Test Vehicle warheads to be delivered to the Air Force. • Continued LEP system level mechanical, electrical, electromagnetic, and abnormal testing. • Continued hydrodynamic physics test to support component First Production and design changes primarily focused on producibility improvement.	• Conduct System Product Definition Documentation Review. • Conduct Nuclear Explosive Safety Study Activities. • Conduct Component Final Design Reviews. • Conduct Component Product Readiness Reviews. • Conduct Component Product Pre-Pilot Production Gates.	
W87-1 Modification Program $541,000,000	**W87-1 Modification Program $680,127,000**	**W87-1 Modification Program +$139,127,000**
• Completed the feasibility study of design options (Phase 6.2) and enter design definition and cost study phase (6.2A). • Advanced technology maturation. • Continued program management and control implementation. • Integrated with Air Force acquisition programs. • Conducted inter-laboratory peer review. • Conducted independent cost review. • Completed initial Major Impact Report (MIR). • Initiated Weapon Design and Cost Report (WDCR) • Completed Phase 6.2 report.	• Mature program management and program controls. • Advance technology maturation and manufacturing readiness levels. • Conduct qualitative risk identification and impact analysis and mature quantitative risk analysis process. • Transition to oversight of the program with Earned Value Management. • Conduct joint testing with the Air Force Global Based Strategic Deterrence (GBSD) and Mk21A program including preparations for the first W87-1 flight test with a GBSD missile.	• The increase represents a transition from Phase 6.2 (Feasibility Study and Design Options) to Phase 6.3 (Development Engineering), including development hardware production to support initial system tests.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)

W93 Program (formerly W93) $53,000,000	W93 Program $240,509,000	W93 Program +$187,509,000
• Conducted Phase 1 Concept Assessment to evaluate warhead architectures and available technologies against potential range of desired attributes, draft military characteristics and known constraints. • Informed the Navy Mk 7 aeroshell development program and assess warhead and aeroshell requirements. • Produced Phase 1 study report and provide recommendations for the Phase 2 Feasibility Study and Design Options. • Coordinated with UK on their Replacement Warhead.	• Continue Phase 2 (Feasibility Study and Design Option) to execute design and decision analysis to down-select the Nuclear Explosive Package (NEP), including conducting Hydro test and modeling/ simulations. • Execute non-nuclear Component (NNC) and surety architecture design configuration options and continue the Feasibility Study. • Continue to conduct customer requirements review with the Navy and begin requirements assignment to lower-level systems and major components. • Initiate Earned Value Management systems in accordance with the M&Os, the Federal Program Office and Navy. • Continue to establish federal program management documents, including a mature Work Breakdown Structure (WBS) to serve as the basis for the Phase 2A (Design Definition and Cost Study) and Weapon Design Cost Report (WDCR) for eventual entry into Phase 3 (Development Engineering). • Continue to coordinate with the UK on their Replacement Warhead. • Begin building and testing W93 relevant protype Non-Nuclear Component hardware and continue to conduct trade Studies leading to design down-select decisions. Initiate comprehensive system-level Nuclear Explosive Physics assessment of Primary designs to support Nuclear system design down-select decisions.	• The increase represents the ramp-up of activities within Phase 2 (Feasibility Study and Design Option), to execute design and decision analysis to down-select the Nuclear Explosive Package (NEP), to include Hydro testing and modeling/simulations. Execute non-nuclear Component (NNC) and surety architecture design configuration options, and continue the Feasibility Study, activities for the Navy, WBS/WDCR activities, initiation of the Earned Value Management system.

Stockpile Management
Stockpile Sustainment

Overview

The Stockpile Sustainment program directly executes maintenance, limited life component exchanges (LLCE), minor alterations, surveillance, assessment, surety studies and capability development, and management activities for all enduring weapons systems in the stockpile. The program includes the B61, W76, W78, W80, B83, W87, and W88 Stockpile Systems, as well as Multi-Weapon Systems (MWS). As required by 50 United States Code (USC) 2525, safety, security, and effectiveness assessments are performed to determine whether the systems can continue to be certified without the need for an underground nuclear test.

Current U.S. nuclear weapons and associated delivery systems

Warheads—Strategic Ballistic Missile Platforms					
***Type* [a]**	***Description***	***Carrier***	***Laboratories***	***Mission***	***Military***
W78	Reentry vehicle warhead	Minuteman III Intercontinental Ballistic Missile	LANL/SNL	Surface to surface	Air Force
W87-0	Reentry vehicle warhead	Minuteman III Intercontinental Ballistic Missile	LLNL/SNL	Surface to surface	Air Force
W76-0/1/2	Reentry body warhead	Trident II D5 Strategic Weapon System (Submarine Launched Ballistic Missile)	LANL/SNL	Underwater to surface	Navy
W88	Reentry body warhead	Trident II D5 Strategic Weapon System (Submarine Launched Ballistic Missile)	LANL/SNL	Underwater to surface	Navy
Bombs—Aircraft Platforms					
***Type* [a]**	***Description***	***Carrier***	***Laboratories***	***Mission***	***Military***
B61-3/4	Non-strategic bomb	F-15, F-16, certified NATO aircraft	LANL/SNL	Air to surface	Air Force/ Select NATO forces
B61-7	Strategic bomb	B-2 bomber	LANL/SNL	Air to surface	Air Force
B61-11	Strategic bomb	B-2 bomber	LANL/SNL	Air to surface	Air Force
B83-1	Strategic bomb	B-2 bomber	LLNL/SNL	Air to surface	Air Force
Warheads—Cruise Missile Platforms					
***Type* [a]**	***Description***	***Carrier***	***Laboratories***	***Mission***	***Military***
W80-1	Air-launched cruise missile strategic weapon	B-52 bomber	LLNL/SNL	Air to surface	Air Force

LANL = Los Alamos National Laboratory
LLNL = Lawrence Livermore National Laboratory
NATO = North Atlantic Treaty Organization
SNL = Sandia National Laboratories

[a] The suffix associated with each warhead or bomb type (*e.g.*, "-0/1" for the W76) represents the modification associated with the respective weapon.

Stockpile Management
Stockpile Sustainment

Description

B61 Stockpile Systems

The B61 gravity bombs are the oldest weapons in the enduring stockpile. The B61 is deployed by the Air Force on various aircraft. The B61 family includes five modifications with two distinct categories. The strategic category includes the B61 Modifications -7 and -11. The non-strategic category includes the B61 Modifications -3 and -4, supporting the Nation's extended nuclear commitment. This program directly executes weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities for the B61 gravity bombs.

W76 Stockpile Systems

The W76-0/1/2 are the warheads integrated into the Trident II D5 Strategic Weapon System. It is part of the Submarine-Launched Ballistic Missile (SLBM) force. The W76-0/Mk4, W76-1/Mk4A, and W76-2/Mk4A are completed by NNSA as a Reentry Body Assembly and delivered to DOD. This program directly executes weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities for the W76 warheads.

W78 Stockpile Systems

The Mk12A/W78 re-entry vehicle is deployed on the Minuteman III Intercontinental Ballistic Missile (ICBM). This program directly executes weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities for the W78 warheads.

W80 Stockpile Systems

The W80 warhead is used in the Air Launched Cruise Missile (ALCM) deployed by the Air Force. This program directly executes weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities for the W80 warheads.

B83 Stockpile Systems

The B83 is an aircraft-delivered, strategic gravity bomb deployed by the Air Force. This program directly executes weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities for the B83 gravity bombs.

W87 Stockpile Systems

The W87-0/Mk21 re-entry vehicle is deployed on the Minuteman III ICBM and will be the first Warhead deployed on GBSD. This program directly executes weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities for the W87 warheads.

W88 Stockpile Systems

The W88 is integrated into the Trident II D5 Strategic Weapon System. It is part of the SLBM force. The W88/Mk5 is completed by NNSA as a Re-entry Body Assembly and delivered to DOD. This program directly executes weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities for the W88 warheads.

Multi-Weapon Systems

Multi-Weapon Systems (MWS) is a multi-weapon, multi-site product-based program that enhances the integration and efficiency of the NNSA's nuclear security enterprise (NSE). The activities within MWS include those which are cross-cutting among sites and/or weapons or cannot be funded by specific weapons programs due to classification restrictions. This program provides multi-weapon products to the NNSA NSE supporting surveillance, reliability, maintenance, product realization, digital engineering, weapons response, nuclear explosive safety, military liaison, integrated surety architecture, and use control for both the current and modernized stockpile.

Major activities within each area

(1) Weapon Maintenance: Includes production of limited-life components (LLCs) including gas transfer systems (GTS), neutron generators (NG), and other designated limited-life components as required by guidance and directive schedules, day-to-day stockpile maintenance and repair activities, production and delivery of components for each weapon type, refurbishment and replacement of aging components to sustain stockpile life and rebuilds.

(2) Weapon Surveillance: Includes Joint Test Assembly (JTA) flight test vehicle and ground testbed builds, new material laboratory and flight tests, retrofit evaluation system laboratory and flight tests, stockpile laboratory tests, stockpile flight tests, quality evaluations, special testing, and component and material evaluation to support assessment of the safety, security, and effectiveness of the nuclear weapons stockpile. Data from these tests contributes to the Annual Assessment and Memorandum to the President.

(3) Weapon Assessment: Includes activities associated with management of fielded weapon systems. Provides systems and component engineering support, support to planning, resolution, and documentation of significant finding investigations (SFIs) to include assessment of root cause, extent of condition, and impact to system effectiveness or safety. Also includes activities associated with planning, developing, and updating the technical basis for the materials, components, and weapons and performing the weapon assessments. Finally, this includes activities associated with preparation, writing, and coordination of Annual Assessment Reports (AARs) and Weapon Reliability Reports (WRRs), as well as activities needed to assess/resolve system-specific weapon response issues and to provide support to the Nuclear Explosive Safety Study Groups (NESSGs) and the Nuclear Weapon System Surety Groups (NWSSGs) as required. Within MWS, activities in this area include use control studies and assessment, surety capability design, development, qualification, production, and integration for the legacy and modern stockpile.

(4) Development Studies/Capability Improvements: Includes activities associated with improvements in surveillance capabilities, technical basis improvements, weapon specific technology maturation for insertion or replacement, JTA development/refresh, and system/surety studies.

(5) Weapon Program Planning/Support: Includes activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, issue resolution, and documentation. Within MWS, includes those activities needed to operate, maintain, and develop products, tools, and applications supporting enterprise product realization through an integrated digital environment and activities associated with external production liaison missions, weapon response, nuclear explosive safety, and technical basis.

Highlights of the FY 2023 Budget Request

- Complete development, qualification, production, and delivery of all scheduled Limited Life Components (LLC) for the B61, W76, W78, W80, B83, W87, and W88. LLCs include gas transfer systems (GTS), neutron generators (NG), and alteration kits delivered to sustain the nuclear weapons stockpile.
- Conduct surveillance program activities for all weapon systems using data collection from flight tests, laboratory tests, and component evaluations to assess stockpile reliability, performance, and safety.
- Conduct Annual Assessment activities for all weapon systems including the in-depth testing and analysis of systems, subsystems, and components.
- Analyze, evaluate, and close high priority Significant Finding Investigations (SFI) in accordance with the currently approved plans.
- Complete legacy component builds on legacy equipment for life of program needs.
- Produce the new electronic neutron generator (ELNG) for the B61-11 program.
- Execute and analyze B61-11 hydrodynamic test to support weapon assessment
- Conduct high explosive qualification and development activities to support production requirements to support B61-12 rebuild schedules.
- Initiate transition activities of the B61 Mod 12 from the LEP to the stockpile.
- Begin procurement and production of B61-12 GTS second cycle components as risk mitigation to reduce restart costs.
- Support of Integrated Surety Architecture (ISA) requirements for B61 Stockpile Systems.
- Conduct full-scale development for the new W76-1 Joint Test Assembly-3 (JTA3) flight test body, an engineering refresh of the existing W76-1 JTA1.
- Development and qualification activities for ALT 939 Integrated Surety Architecture (ISA) implementation on the W76 family of warheads.
- Continue Phase 6.3 (Development Engineering) of the W76-1/2 Mk4B development and qualification program.

- Conduct pre-production activities and development of W78 JTA6R to replace obsolete W78 JTA6 components to support future flight test missions.
- Conduct W78 repair activities.
- Execute ALT 369 surveillance production activities for the W80-1 program.
- Begin W80-1 high explosive safety and hydrodynamic testing to support weapon assessment.
- Execute W80-1 procurements for abnormal heating safety tests.
- Complete B83 abnormal thermal safety test.
- Execute electrostatic discharge quantitative analysis to support B83 weapon response
- Produce W87 ALT 360 GTS.
- Integration of W87-0 with the Air Force's Ground Based Strategic Deterrent (GBSD) replacement for the Minuteman III (MMIII) and the Mk21 Fuze.
- Support Air Force execution of MMIII to GBSD transition for W87-0 and W78.
- Execute W87-0 NG retrofit repairs and rebuild activities.
- Develop and produce firing set assemblies (FSA) and JTA components, including canned subassembly (CSA) simulator (Sim), for the W87-0.
- Develop new SS-21 tooling for the W87-0 program at Pantex.
- Complete qualification of W88 ALT 940 ISA and meet initial operational capability.
- Produce W88 ALT 940 ISA components.
- Produce GTS and NG for W88 ALT 370 to support stockpile sustainment.
- Conduct procurement and installation of the Safeguard Transporter (SGT) Capability Retrofit (SCR) as the ISA application for transportation SGT solutions.
- Execute ISA logistics hub operations for DOE/NNSA transportation in accordance with ISA requirements and schedules.
- Conduct stockpile sustainment activities providing products, components, and/or services to execute multi-weapon surveillance, weapons reliability reporting to DOD, weapon logistics and accountability, special materials, and stockpile planning.
- Provide multi-system weapon response, nuclear explosive safety, and external production resources ensuring safe nuclear explosive operations.
- Continue implementation of multi-system ISA requirements across the stockpile, specifically with progress toward IOC of Enhanced Capability Shipping Configurations.
- Conduct multi-system use control system studies and assessments.
- Design, develop, qualify, and produce surety capabilities aligned with weapon schedules and enduring stockpile refresh opportunities.

FY 2024 – FY 2027 Key Milestones

- Integrate the B61-12 into stockpile sustainment to include LLC production, surveillance, and annual assessment activities.
- Complete B-21 aircraft nuclear compatibility certifications for the B61.
- Begin full rate production of B61-12 GTS second cycle components.
- Begin production of high explosive (PBX 9502) components to support B61-12 rebuilds.
- Fully produce and field ISA capability for the B61-12.
- Complete W76 Mk4B Final Design Review in FY 2024.
- Complete W76 JTA3 Baseline Design Review in FY 2024.
- Complete W76 ALT 939 Final Design Review in FY 2025.
- Achieve W76 Mk4B First Production Unit (FPU) in FY 2026.
- Achieve W76 ALT 939 FPU in FY 2026.
- Execute W76 JTA3 Final Design Review in FY 2026.
- Complete W78 repairs in FY 2026.
- Achieve W78 JTA6R FPU in FY 2027.
- Execute ALT 369 surveillance replacement builds for the W80.
- Initiate implementation of ISA capability for the W80-1 in FY 2027.
- Conduct W80 disassembly activities for conversion to W80-4.
- Accomplish the "-05" firing set assembly FPU for the W87 in FY 2024.

- Integrate Mk21 fuze modernization for the W87 in FY 2024.
- Achieve first Joint Environmental Test Unit (JETU) flight for W87 GBSD in FY 2024.
- Achieve JTA1-3 and JTA4b flight test vehicle qualification flights for W87 GBSD starting in FY 2026.
- Complete 1E38 Detonator Lot 3811 in FY 2025 for the W88.
- Complete SGT Capability Retrofit (SCR) and transition to sustainment operations (MWS).
- Execute Cell 8 Project at Pantex supporting enhanced pit staging configurations (MWS).
- Deliver use control systems studies and capabilities (MWS).
- Deliver Weapon Reliability Report to DOD annually (MWS).
- Complete engineering support to bring a third centrifuge at WETL online (MWS).
- Deliver digital capabilities that improve the product realization processes across the nuclear security enterprise (MWS).

FY 2021 Accomplishments

- Delivered all scheduled LLCs for the B61, W76, W78, W80, B83, W87, and W88.
- Conducted surveillance activities for all weapon systems using data collection from flight tests, laboratory tests, and component evaluations to assess stockpile reliability without nuclear testing which culminated in completion of all Annual Assessment Reports and generation of Laboratory Director Letters to the President.
- Completed B61-Mod 11 fragmentation test successfully with validated data analysis.
- Reaccepted B61 JTA components by referencing newly developed reacceptance criteria.
- Continued planning and early development for the W76 JTA 3 (JTA1 refresh). Completed W76-1 JTA3 associated feasibility gate reviews.
- Implemented tailored analysis of alternatives study to replace H1333B shipping container for W76 warheads with H1514D container.
- Conducted W78 repairs.
- Continued development of the W78 JTA6R (JTA6 Refresh).
- Completed FY 2021 W80-1 ALT 369 deliveries to the Air Force.
- Conducted W80-1 ISA product realization team support of ISA implementation plans.
- Executed two W80-1 ALCM JTA8 flight tests.
- Completed the last “major portion” unit of W80-1 ALT 369 at Pantex.
- Completed a congressional report detailing the current status and surveillance findings for the B83.
- Met requirements for W87-0 small ferroelectric neutron generator retrofits.
- Conducted W87-0 integration activities to support MK21 replacement fuze and GBSD including JETU, JTA4a and JTA4b flight test vehicle development.
- Achieved W87-0 -107 FSA FPU and continued development and production activities for-05 FSA and other non-nuclear components.
- Completed development of W88 ALT 940 ISA transportation surety solution and initiated production activities.
- Met FPU for W88 ALT 940 Mechanical Module.
- Met FPU for W88 H1514C containers and began deliveries to the DOE/NNSA and DOD.
- Delivered the Weapon Reliability Report to the DOD.
- Completed required Weapons Evaluation Test Laboratory (WETL) lab test requirements.
- Achieved FPU ahead of schedule for Code Management System (CMS) Controller.

Stockpile Sustainment

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Stockpile Sustainment $998,357,000	**Stockpile Sustainment $1,321,139,000**	**Stockpile Sustainment +$322,782,000**
Overall: • Produced and conducted LLCE operations. • Conducted surveillance activities, including disassembly and inspection (D&I), system-level laboratory tests, joint flight tests, component and material evaluations, and assessment. • Conducted weapon assessment activities necessary to complete WRRs and AARs, to include analyses of laboratory testing and SFIs, as required. • Executed activities associated with management of fielded weapon systems. • Provided systems and component engineering support for planning, resolution, and documentation.	Overall: • Execute weapon maintenance, limited life component exchanges, minor alterations, surveillance, assessment, capability development and management activities. • Produce and conduct LLCE operations. • Conduct surveillance activities, including D&I, system-level laboratory tests, joint flight tests, component and material evaluations, and assessment. • Conduct weapon assessment activities necessary to complete WRRs and AARs, to include analyses of laboratory testing and SFIs, as required. • Implement integrated surety architecture (ISA) capabilities and conduct multi-system implementation studies. • Develop, qualify, and produce weapon surety capabilities. • Execute activities associated with management of fielded weapon systems. • Provide systems and component engineering support for planning, resolution, and documentation.	Overall: • The increase primarily represents W76 Mk4B development and qualification; design, development, qualification, and production of weapon surety capabilities; implementation of ISA in accordance with the 2018 NDAA; development and deployment of product realization and digital engineering tools and applications; transition of the B61-12 into stockpile; high explosive component development and production; special material procurement supporting limited life components (LLCs); Joint Test Assembly (JTA) flight test vehicle development and production; and activities supporting Air Force transition from MMIII to GBSD. • Additional details for the individual Stockpile Systems explanation of change are listed below.
B61 Stockpile Systems	*B61 Stockpile Systems*	*B61 Stockpile Systems*
• Produced neutron generators for the B61-11. • Executed weapon assessment activities necessary to support the transition of the B61-12 into the stockpile.	• Begin sustainment activities of B61-12 to include system management, annual assessment, joint test assembly (JTA) development and procurement, canned sub-assembly (CSA) retrofit evaluation system test	• The increase represents transition of B61-12 into stockpile sustainment including system management, annual assessment, JTA development and procurement, CSA REST surveillance, and technical basis development;

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
• Conducted analysis supporting weapon reliability and annual assessment including analyses of laboratory testing and significant finding investigations. • Conducted activities associated with management of fielded weapon systems to support the transition of the B61-12 into the stockpile. • Performed development and qualification activities to support ISA requirements. • Conducted ISA feasibility studies in conjunction with DOD for the B61 family of systems.	(REST) surveillance, and technical basis development. • Execute and analyze a B61-11 cable pull down and hydrodynamic test to support weapon assessment. • Execute high explosive qualification and development activities to support B61-12 rebuild schedules. • Development and qualification activities to support ISA requirements.	qualification and development of high explosive components to support B61-12 rebuild schedules; and execution and analysis of a B61-11 hydrodynamic test to support weapon assessment.
W76 Stockpile Systems	*W76 Stockpile Systems*	*W76 Stockpile Systems*
• Conducted development of W76-1 JTA3 to achieve FPU prior to JTA1 end of life. • Started ALT 939 development activities to support ISA implementation on the W76-1 and W76-2.	• Conduct joint development and qualification activities with the Navy on the Mk4B for the W76-1 and W76-2 systems. Development and qualification activities includes warhead level ground testing and analysis, component qualification testing and analysis, execution of Phase 6.3 (Development Engineering) reviews, and planning for authorization of Mk4B nuclear explosive operations at Pantex for warhead conversion from Mk4A to Mk4B configuration for warhead FPU and quantity production. • Continue full program execution for development and qualification of W76-1 JTA3 to ensure on time FPU prior to JTA1 end of life. • Continue ALT 939 development and pre-production activities to support ISA implementation on the W76-1 and W76-2 systems.	• The increase represents W76 Mk4B development and qualification, JTA3 development and qualification, and ALT 939 ISA development activities.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
W78 Stockpile Systems	*W78 Stockpile Systems*	*W78 Stockpile Systems*
• Conducted JTA6R technology development (JTA6 flight test vehicle refresh) and pre-production activities. • Initiated planning for ISA development.	• Conduct JTA6R technology development including qualification testing and component production. • Conduct W78 repair activities. • Complete detonator production. • Support Air Force execution of MMIII to GBSD transition.	• The increase represents the JTA6R qualification testing and component production, detonator production, and MMIII to GBSD transition activities.
W80 Stockpile Systems	*W80 Stockpile Systems*	*W80 Stockpile Systems*
• Completed W80 ALT 369 production. • Performed development and qualification activities to support ISA/MTAD requirements.	• Conduct W80 ALT 369 surveillance replacement builds. • Begin assembly process re-qualification to support JTA3 authorization basis. • Continue W80 disassembly activities for conversion to W80-4. • Begin high explosive safety and hydrodynamic testing activities to support weapon assessment. • Execute procurements for abnormal heating safety tests. • Continue ISA qualification and production activities.	• The increase represents procurements for abnormal heating safety tests, weapon assessment activities to conduct high explosive safety and hydrodynamic testing, JTA3 re-qualification, and ISA qualifications and production.
B83 Stockpile Systems	*B83 Stockpile Systems*	*B83 Stockpile Systems*
• Conducted activities to support stockpile decision by the Nuclear Weapons Council including analysis and planning for two alterations and a joint test assembly replacement. • Performed technical studies and readiness activities to restart nuclear explosive operations at Pantex.	• Conduct surveillance activities, including D&Is, system-level laboratory tests, joint flight tests, CMEs, and assessment. • Complete the abnormal thermal safety test. • Execute electrostatic discharge quantitative analysis to support weapon response and safe handling operations. • Execute surveillance backlog from disassembly pause at Pantex.	• The increase represents execution of backlogged surveillance activities due to suspended nuclear explosive operations and executing electrostatic discharge quantitative analysis to support weapon response and safe handling operations; and does not include activities for two alterations and a joint test assembly replacement.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
W87 Stockpile Systems	*W87 Stockpile Systems*	*W87 Stockpile Systems*
• Continued Ground Based Strategic Deterrent (GBSD) qualification activities. • Continued firing set development and production activities for out-year stockpile rebuilds.	• Conduct GTS production to support LLCE deliveries and hedge. • Execute W87-0 NG retrofit repairs and rebuild activities. • Conduct firing set development and production activities for out-year stockpile rebuilds. • Support GBSD qualification activities with the DOD including test planning, flight test vehicles development, and supporting stockpile hardware planning. • Support integration of W87-0 with GBSD replacement for the Minute Man III (MMIII) and the Mk21 fuze. • Produce joint test assembly components including canned subassemblies (CSA) Simulator (Sim).	• The increase represents hardware procurements and production to support rebuilds, repairs, and GBSD integration; production of JTA components including canned subassembly (CSA) simulator; and MMIII to GBSD transition activities.
W88 Stockpile Systems	*W88 Stockpile Systems*	*W88 Stockpile Systems*
• Continued system level qualification activities for surety enhancements, began production of ALT 940. Executed H1514C container production. • Continued system level qualification activities for SGT Capability Retrofit (SCR) ISA transportation solution and began production activities. • Established ISA logistics hub operations at Kansas City New Mexico Operations (KC-NMO) in support of ISA employment. Completed required physical and security upgrades at the logistics hub.	• Produce ALT 940 ISA system and associated components. • Complete system level qualification activities for SCR ISA transportation and continue production activities.	• The decrease represents the ALT 940 project transition from development and qualification to initial system-level production. It also represents the transition of ISA logistics hub operations to MWS for long-term operations and sustainment.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Multi-Weapon Systems	*Multi-Weapon Systems*	*Multi-Weapon Systems*
• Conducted use control capability development, equipment procurements and studies supporting LEP FPUs, the enduring stockpile, and external deliverables. • Conducted use control training and capability integration with DOD customers. • Completed complex-wide studies and multi-weapon activities that analyze the comprehensive security risk and consequence analysis of nuclear weapon systems against specific threats. • Designed, developed, produced, and maintained multi-weapon handling and test gear supporting weapon logistics. • Performed production and maintenance of test and handling gear, spare parts for DOD, and containers. • Coordinated and managed LLC delivery and schedules with DOD. • Procured and managed special material inventories supporting LLCs. • Maintained storage capacity and provide safe, secure, and compliant storage of Special Nuclear Material (SNM) at the Pantex Plant, and conduct required SNM surveillance activities supporting the stockpile assessment. • Conducted multi-system weapon response and conduct nuclear explosive safety studies for un-interrupted operations at the Pantex Plant. • Conducted multi-weapon surveillance activities and tester development. • Operated and maintained Product Realization Integrated Digital Enterprise (PRIDE) systems to include design, product as-built, surveillance,	• Conduct use control capability development, equipment procurements and studies supporting LEP FPUs, the enduring stockpile, and external deliverables. • Operate and maintain the ISA logistics hub as a cross-cutting function across all ISA enabled systems. • Procure and manage special material inventories supporting LLCs. • Operate and maintain Product Realization Integrated Digital Enterprise (PRIDE) systems to include design, product as-built, surveillance, and dismantlement information in support of the Stockpile Management mission from design through dismantlement. • Develop and deploy new product realization tools and applications to support stockpile sustainment and modernization activities within a digital engineering and model-based system engineering integrated environment. • Support cybersecurity requirements for digital engineering tools and applications. • Conduct use control training and capability integration with DOD customers. • Execute complex-wide studies and multi-weapon activities that analyze the comprehensive security risk and consequence analysis of nuclear weapon systems against specific threats. • Design, develop, produce, and maintain multi-weapon handling and test gear supporting weapon logistics.	• The increase represents design, development, and production of surety capabilities supporting multiple weapon systems; an increase in material procurement requirements to support LLCs for stockpile sustainment and modernization; an increase to support development and deployment of enhanced product realization tools and applications; an increase to support development and implementation of enterprise digital engineering architectures and tools; an increase to support increased cybersecurity requirements of mission applications; an increase to support multi-weapon ISA sustainment; an increase to support additional nuclear explosive safety activities and weapon response in line with increased throughput at Pantex; and an increase for the transition of ISA logistics hub operations to MWS for sustained operations and maintenance.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
and dismantlement information in support of the Stockpile Management mission from design through dismantlement. • Responded to DOD Unsatisfactory Reports (URs) in response to potential issues with the stockpile. • Provided DOD training on weapons maintenance activities in the field. • Delivered Weapon Reliability Report (WRR) to DOD annually.	• Perform production and maintenance of test and handling gear, spare parts for DOD, and containers. • Coordinate and manage LLC delivery and schedules with DOD. • Maintain storage capacity and provide safe, secure, and compliant storage of SNM at the Pantex Plant, and conduct required SNM surveillance activities supporting the stockpile assessment. • Conduct multi-system weapon response and conduct nuclear explosive safety studies for un-interrupted operations at the Pantex Plant. • Conduct multi-weapon surveillance activities and tester development. • Deliver the WRR to DOD annually. • Respond to DOD Unsatisfactory Reports (URs) in response to potential issues with the stockpile. • Provide DOD training on weapons maintenance activities in the field.	

Stockpile Management
Weapons Dismantlement and Disposition

Overview

The Weapons Dismantlement and Disposition (WDD) program provides weapon dismantlements, safety studies on retired systems, material characterization, legacy component disposition, and the disposal of retired weapon parts. Includes activities for technical analysis needed to dismantle and safely store weapons being removed from the stockpile.

Stockpile Management
Weapons Dismantlement and Disposition

Description

Weapons Dismantlement and Disposition (WDD) is a critical element of NNSA's integrated effort to transform the enterprise and the stockpile. Specific activities include weapons disassembly, recycling of material and hardware for LEPs, disposition of retired warhead system components, and ensuring components are available for safety testing. Other supporting activities specific to retired warheads include conducting hazard assessments, issuing safety analysis reports, conducting laboratory and production plant safety studies, and declassification and sanitization of component parts. WDD relies on several enabling programs to complete its mission, such as the Office of Stockpile Production Integration for shipping, receiving, and equipment maintenance; Infrastructure and Operations for infrastructure sustainment and containers; and the Office of Secure Transportation for the movement of weapons and weapon components.

WDD focuses on the safe and secure dismantlement of excess nuclear weapons and components. The WDD program has four major activities:

(1) **Disassembly** – WDD enables the dismantlement of weapons and canned subassemblies and is a significant supplier of material for future nuclear weapons production and Naval Reactors.

(2) **Component Disposition** – WDD ensures waste streams are identified to allow for the permanent disposition of weapon components.

(3) **Retired Systems Management** – WDD enables safety studies that ensure weapons in the stockpile awaiting dismantlement remain safe while in DOD custody.

(4) **Component Characterization** – WDD ensures that all potential hazards contained in weapon components are characterized to allow the weapons complex to safely work with individual weapon components.

Highlights of the FY 2023 Budget Request

- Execute a weapon dismantlement program consistent with the priorities of the LEPs, stockpile, and Naval Reactors.
- Execute annual activities as stated in the Production and Planning Directive.
- Provide enriched uranium, lithium, and components to the LEPs and external customers.
- Perform legacy component disposition activities.

FY 2024 – FY 2027 Key Milestones

- Conduct dismantlement activities consistent with the Nuclear Weapons Stockpile Memorandum.
- Reduce the size of legacy disposition inventories at each site.
- Eliminate excess power supplies from Pantex inventories.
- Develop processes and procure equipment to support dismantlement of special CSAs.

FY 2021 Accomplishments

- Met stockpile and naval reactor requirements through prioritized weapon and component dismantlement schedules.
- Maintained focus on the Pantex FY 2022 dismantlement program of record.
- Dispositioned weapon program components, keeping legacy piles from growing.
- Managed dismantlement system safety concerns on time.
- Conducted component characterization of hazards on time with no impact to worker safety.

Weapons Dismantlement and Disposition

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Weapons Dismantlement and Disposition (WDD) $56,000,000	**Weapons Dismantlement and Disposition (WDD) $50,966,000**	**Weapons Dismantlement and Disposition (WDD) -$5,034,000**
• Continued safe and secure dismantlement of nuclear weapons and components in excess of national security requirements. • Recycled material and components from dismantled unites required for LEPs, the stockpile, and other customers. • Reduced Legacy component inventories to make space available for incoming LEP material.	• Continue safe and secure dismantlement of nuclear weapons and components in excess of national security requirements. • Recycle material and components from dismantled units required for LEPs, the stockpile, and other customers. • Continue effort at minimal levels to decrease Legacy component inventories to make space available for incoming LEP material.	• The decrease represents a reduction in disposition of legacy component inventories.

Stockpile Management
Production Operations

Overview

Productions Operations is a multi-weapon system manufacturing-based program that drives individual site production capabilities and capacity for the stockpile sustainment and modernization programs, including limited life component production and weapon assembly and disassembly operations. Production Operations also provides maintenance and calibration services for manufacturing operations to meet DOD War Reserve requirements. Production Operations scope covers sustainment of labor required for weapon systems capabilities that enable individual weapon production and are not specific to one material stream. Facility major modernization and construction activities are not part of this budget subprogram and are covered in other parts of the Weapons Activities account.

Production Operations:

Provides the manufacturing labor capabilities (e.g., engineering, manufacturing, quality assurance) and capacity for Major Modernization and enduring stockpile production, weapon assembly, weapon disassembly required to meet NNSA schedules and meet DOD delivery schedules.

Supports the development, qualification, and production of Neutron Generator Assemblies (NGA) shippable items and shelf-life units; in addition, manufactures detonators and detonator cable assemblies.

Expands engineering and quality assurance processes responsive to increased non-nuclear component production requirements.

Provides programmatic equipment maintenance scope for SNL and KCNSC transferred from the Infrastructure and Operations portfolio; KCNSC expansion and equipment relocation; and hiring of critical skilled labor resources to support increase in production activities.

Stockpile Management
Production Operations

Description

Production Operations provides a multifaceted, skilled labor force, focusing on 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 production mission. Production Operations also refreshes and replaces production capabilities and supports programmatic equipment maintenance to improve efficiency and ensure manufacturing operations meet future DOD requirements. Production Operations requires close coordination with several NNSA Offices to ensure the correct capabilities are in place on time to support stockpile demands.

Production Operations major activities include the following:

- **Engineering Operations** – Internal plant-wide activities that establish product process flows and improvements, develop and maintain operating procedures, determine critical design parameter and manufacturing process capabilities, establish process controls, metrics, and quality indices, and establish and maintain process safety controls/assessments.
- **Manufacturing Operations** – Activities that manage and provide oversight to manufacturing departments and all internal non-weapon-type specific manufacturing operations and processes, material controls, supervision, planning and scheduling, inventory control, packaging, shipping and procurement, internal production-related transportation, and internal production related safety activities. It also includes classified manufacturing operations that cannot be associated with a particular warhead.
- **Quality, Supervision, and Control** – Includes activities dealing with quality control, supervision of general in-line inspection and radiography, procedures development and execution, process control certification for War Reserve products, measurement standards and calibration techniques, calibration of equipment, tooling, gages and testers, and Quality Assurance (QA)-related equipment/processes for certification.
- **Tool, Gage, and Equipment Services** – Activities that include preparation of specifications and designs for non-weapon-type specific tooling including tools, gages, jigs and fixtures and test equipment, as well as design and development of tester software including tester control and product assurance. This category also includes work related to verification/qualification of hardware and software, procurement processes, and maintenance, both corrective and preventative, that directly support production-related equipment/process components.
- **Purchasing, Shipping, and Materials Management** – Planning, engineering, supplier management, and logistics activities associated with the materials supply chain.
- **Electronic Product Flow** – Activities that include internal plant-wide purchase, design, development, installation, configuration, testing, training, and maintenance of classified and unclassified computer systems including hardware and software. These activities are directly linked to the performance of site-specific production functions but are separate and distinct from general-use administrative and office-automated systems. Supported systems in both unclassified and classified environments enable manufacturing and quality assurance functions.

Highlights of the FY 2023 Budget Request

- Provides support to both KCNSC and SNL for programmatic equipment maintenance.
- Continues support for the Neutron Generator Enterprise and detonator production activities.
- Provides support for the KCNSC expansion and equipment relocation.
- Provides support for equipment maintenance to ensure mission deliverables are met for the Sustainment, WDD, and Major Modernization programs.
- Hiring critical skilled labor resources to support increase in production activities.
- Completes deployment of initial Enterprise Capacity Analysis capability.

FY 2024 – FY 2027 Key Milestones

- Increase critical skilled labor to maintain Stockpile Major Modernization scope and schedules.
- Continue support of programmatic equipment maintenance.
- Continue support of KCNSC Expansion.
- Support projected peak detonator production at LANL.
- Sustain Neutron Generator Enterprise capacity through end of projected wave of manufacturing and ship demand.

FY 2021 Accomplishments

- Sustained labor base that spans multiple programs to meet current stockpile deliverables and NNSA's production mission.
- Completed calibration services of over 1,400 critical equipment calibrations on-time in support of production activities.
- Supported ~800 LLNL Engineering Authorizations (EA), ~800 NSE EAs, and ~360 PRT meetings.
- Deployed and executed CNS Y-12 comprehensive corrective and preventative maintenance program activities for production related equipment enabling the site to complete modernization, surveillance, and dismantlement deliverables.
- Performed tritium process computing maintenance to support LLCE GTS production and GTS surveillance and classified communications/data management.
- Accepted over 130,000 SNL components at a 100% NNSA acceptance rate.

Production Operations

Activities and Explanation of Changes

<table>
<tr><th>FY 2021 Enacted</th><th>FY 2023 Request</th><th>Explanation of Changes
FY 2023 Request vs
FY 2021 Enacted ($)</th></tr>
<tr><td>Production Operations $568,941,000</td><td>Production Operations $630,894,000</td><td>Production Operations +$61,953,000</td></tr>
<tr><td>• Continued engineering operations for weapon operations including LEP, surveillance, dismantlement, and component production to meet directive schedules and meet DOD delivery schedules.
• Continued base production capability to meet Neutron Generator production build plan as defined in the approved NG Enterprise Integrated Program Plan (NIPP) responsive to five weapon system product line ship/delivery schedules.
• Continued base production capability to meet detonator production build plan as defined in the approved Detonator Production and Surveillance Program Execution Plan supporting seven product line weapon system ship/delivery schedules. Executed activities to enable on-time completion of deliverables by ensuring process equipment availability.
• Provided labor and supplies for increased preventative and corrective maintenance, including equipment calibration throughout the enterprise supporting increased LEP and Major ALT workload.
• Continued engineering and quality assurance expansion for increased non-nuclear component production requirements.
• Increased intra-site logistical support required to support weapon and component moves related to production.</td><td>Supports base labor operations and activities at:
• KCNSC: Executes programmatic equipment maintenance, calibration services, analytical sciences, industrial engineering, and production/materials management.
• LANL: Supports manufacturing of detonators and detonator cable assemblies.
• LLNL: Independent quality engineers in support of Stockpile Major Modernization Programs.
• Pantex: Executes multi-system hardware procurements, testing & storage. On-site transportation of Special Nuclear Materials and High-Explosives.
• Y-12: Supports corrective & preventative maintenance for production equipment and accountability & control activities for Special Nuclear Materials.
• SNL: Executes programmatic equipment maintenance for MESA & Primary Standards Lab; supports development, qualification & production of Neutron Generator Assemblies
• SRS: Supports tritium process controls with classified computing systems and programmatic equipment for GTS reservoir gas analysis.</td><td>• The increase represents programmatic equipment maintenance scope for SNL and KCNSC transferred from the Infrastructure and Operations portfolio; KCNSC expansion and equipment relocation; and hiring of critical skilled labor resources to support increase in production activities.</td></tr>
</table>

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
• Continued engineering and quality assurance preparation for B61-12 and W88 ALT 370 non-nuclear component production. • Developed policy implementation strategies, tools, and techniques for use across programs and all sites in the NSE to reduce the risks of subversion. • Refined and deployed NEA awareness education across the NSE and site-specific training at all sites. • Supported Model Based Enterprise initiatives which allow NNSA to seamlessly exchange classified 3-dimensional product definition via common Computer Aided Drafting and Design (CADD) architecture from weapon component sourcing to quality inspection.		

Stockpile Management
Nuclear Enterprise Assurance

Overview

NNSA will initiate the Nuclear Enterprise Assurance (NEA) subprogram to actively manage subversion risks to nuclear weapons and associated design, production, and testing capabilities throughout the Phase 6.X (Weapons Acquisition) Process. NEA enables the responsible use of digital technologies in the modernization of weapons, facilities, and engineering capabilities, by preventing, detecting, and mitigating potential consequences of subversion in digital technologies, the supply chain, and other threat pathways. NEA includes technical and governance activities for the assurance of components integral to weapon systems, operational technologies directly related to weapons, and capabilities that cross-cut multiple weapons programs.

Stockpile Management
Nuclear Enterprise Assurance

Description

Nuclear Enterprise Assurance (NEA) ensures the Nuclear Security Enterprise (NSE) actively manages subversion risks to the nuclear weapons stockpile and associated design, production, and testing capabilities. Digital technologies introduce new vulnerability characteristics and multiple new susceptible pathways that, if compromised, can produce unacceptable physical impacts to safety, the environment, weapon performance, and loss of capabilities. Using the nuclear weapon digital assurance (NWDA) process, NEA enables risk-managed adoption of leading-edge technologies to meet emerging military requirements and reduce modernization schedules and costs. NEA maintains a team of multi-disciplinary experts who perform rapid assessments, develop tools and assurance methods, and provide recommended mitigations. Close coordination is maintained across NNSA and other agencies to stay informed of current threats and best practices.

NEA focuses on technical and governance activities for the assurance of digital systems integral to weapon systems, operational technologies directly related to weapons, and capabilities that cross-cut multiple weapons programs. The NEA program has four major activities:

(1) **Assurance Evaluations and Recommendations –** Cross-site, multi-disciplinary teams of subject matter experts from all NNSA sites who rapidly perform vulnerability risk assessments; develop and mature assurance methods; and provide recommended mitigations and implementation plans across NNSA programs. These activities also address non-program-specific NEA risks (e.g., supply chain integrity) through cross-cutting capabilities and process development.

(2) **Tools and Capabilities** – Cross-cutting and non-program-specific tools and capabilities that assist in vulnerability discovery, consequence analysis, and mitigation implementation.

(3) **Policy, Requirements, and Oversight** – Activities include developing and informing NNSA and DOE policies, orders, and directives to ensure integrated governance and compliance with federal law; coordination with DOD and UK partners; and establishing quantifiable metrics to assess the performance of NEA policies, requirements, and NSE execution.

(4) **Workforce Standards** – Creates standards and processes for NSE-wide NEA awareness, training, and skills development. Activities include integrating an NWDA approach for weapons and associated design, production, and testing capabilities throughout the NSE.

Highlights of the FY 2023 Budget Request

- Establish cross-site, multi-disciplinary assurance capability.
- Address highest priority subversion risks at each of the eight NNSA sites.
- Institute cybersecurity of nuclear weapon policy, requirements, and oversight processes.
- Establish, update, and expand NEA training and qualification programs.

FY 2024 – FY 2027 Key Milestones

- Address most significant subversion risks as determined by mission impact at all eight NNSA sites.
- Institutionalize NEA policy, training, and qualification programs across NNSA.
- Mature countersubversion tools and capabilities and assurance standards for the workforce.

FY 2021 Accomplishments

- This is a new subprogram.

Nuclear Enterprise Assurance (NEA)

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Nuclear Enterprise Assurance (NEA) $0	**Nuclear Enterprise Assurance (NEA) $48,911,000**	**Nuclear Enterprise Assurance (NEA) +$48,911,000**
• N/A.	• Establish cybersecurity of nuclear weapon information technology (NWIT) policy, processes, and requirements. • Establish NWIT training and certification program. • Establish a government-led NEA Core Team of multidisciplinary subject matter experts. • Establish NEA Core Team qualification program. • Initiate site-specific NEA subject matter expert teams. • Develop implementation plan for long-term assurance of non-nuclear components logistics systems. • Complete NEA assessments and mitigation plans for highest mission-consequence operational technologies at each of the eight NNSA sites. • Establish NEA measure-of-success process. • Improve and expand NEA assurance laboratories and tools.	• The increase represents the establishment of NEA as a new Stockpile Management subprogram to actively manage subversion risks to the nuclear weapons stockpile and associated design, production, and testing capabilities.

Stockpile Management
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	40,847	78,744	105,314	+64,467
Minor Construction	N/A	N/A	46,473	65,079	30,865	-15,608
Total, Capital Operating Expenses	**N/A**	**N/A**	**87,320**	**143,823**	**136,179**	**+48,859**
Capital Equipment > $500K (including MIE)						
Total Non-MIE Capital Equipment (>$500K and <$5M)	N/A	N/A	36,491	37,294	38,114	+1,623
Life Extension Program Project 4, Y12	28,750	0	2,800	25,950	0	-2,800
Multi-Mass Leak Detector, Y-12	7,813	6,257	1,556	0	0	-1,556
South e-Beam Welder Project, Y-12	15,200	0	0	15,200	0	0
GB03 Airlock/Hood Replacement & Upgrades, Y-12	8,300	0	0	300	8,000	+8,000
Large Graphite/VTL Lathe #1, Y-12	5,000	0	0	0	5,000	+5,000
Graphite Drying Oven #1, Y-12	5,000	0	0	0	5,000	+5,000
General Shop Drying Oven, Y-12	5,000	0	0	0	5,000	+5,000
Coordinate Measuring Machine #1, Y-12	5,000	0	0	0	5,000	+5,000
Coordinate Measuring Machine #2, Y-12	5,000	0	0	0	0	0
Coordinate Measuring Machine #3, Y-12	5,000	0	0	0	0	0
Coordinate Measuring Machine #5, Y-12	5,000	0	0	0	0	0
Press Support Equipment, Y-12	8,000	0	0	0	8,000	+8,000
Press Equipment, Y-12	5,200	0	0	0	5,200	+5,200
Ultrasonic Machine #2, Y-12	5,200	0	0	0	5,200	+5,200
Ultrasonic Machine #3, Y-12	5,200	0	0	0	5,200	+5,200
Ultrasonic Machine #4, Y-12	5,200	0	0	0	5,200	+5,200
Ultrasonic Machine #5, Y-12	5,200	0	0	0	5,200	+5,200
Ultrasonic Machine #6, Y-12	5,200	0	0	0	5,200	+5,200
Graphite Drying Oven #2, Y-12	5,000	0	0	0	0	0
Solution Heat Treat Furnace, Y-12	18,000	0	0	0	0	0
9204-2E High Temperature Ovens (Final Assembly), Y-12	18,000	0	0	0	0	0
9201-5N Dye Pent/Ultrasonic Tanks, Y-12	18,000	0	0	0	0	0
Component Canning Box, Y-12	15,000	0	0	0	0	0
Large Graphite/VTL Lathe #2, Y-12	5,000	0	0	0	0	0
Large Graphite Lathe #3, Y-12	5,000	0	0	0	0	0
SNMV Purchase/Replacement, Y-12	5,000	0	0	0	0	0
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**40,847**	**78,744**	**105,314**	**64,467**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Minor Construction Projects (Total Estimated Cost (TEC)						
Total Minor Construction Projects (TEC <$5M)	N/A	N/A	29,550	30,200	30,865	+1,315
SNL CA High Security Office Modular Addition, SNL	13,500	0	7,800	5,700	0	-7,800
12-64 Bays 11, 12 & 15 Replacement Facilities, PX[a]	5,283	0	0	0	0	0
12-44, Cell 8, PX[b]	8,000	1,150	3,873	2,977	0	-3,873
Mass Spec Replacement Project #1A: New Inert Mass Spec (New MS #5) 234-H Room 301, SR	5,500	0	1,500	4,000	0	-1,500
9990-03 Facility Upgrades, Y-12	19,952	0	1,750	18,202	0	-1,750
Building 9201-1 Pangborn Upgrades, Y-12	6,000	0	2,000	4,000	0	-2,000
Total, Minor Construction Projects	**N/A**	**N/A**	**46,473**	**65,079**	**30,865**	**-15,608**
Total, Capital Summary	**N/A**	**N/A**	**87,320**	**143,823**	**136,179**	**+48,859**

[a] Project originally notified in FY 2018 under Directed Stockpile Work. Project was moved to Stockpile Management as part of the FY 2021 Weapons Activities Budget restructuring but was erroneously included in the Production Modernization Capital Summary in the FY 2021 and FY 2022 Congressional Budget Requests. Re-notifying under Stockpile Management to reflect correct funding location.

[b] Project originally notified and funded in FY 2020 under Directed Stockpile Work. Project was moved to Stockpile Management as part of the FY 2021 Weapons Activities Budget restructuring, but was erroneously included in the Production Modernization Capital Summary in the FY 2021 and FY 2022 Congressional Budget Requests. This reflects the correct funding location (SM) starting in FY 2021.

Stockpile Management
Outyear Capital Summary

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))					
Capital Equipment >$500K (including MIE)	79,953	67,810	40,686	74,081	N/A
Minor Construction	32,844	36,220	32,947	33,672	N/A
Total, Capital Operating Expenses	**112,796**	**104,030**	**73,632**	**107,752**	**N/A**
Capital Equipment > $500K (including MIE)					
Total Non-MIE Capital Equipment (>$500K and <$5M)	38,953	39,810	40,686	41,581	N/A
Coordinate Measuring Machine #2, Y-12	0	5,000	0	0	0
Coordinate Measuring Machine #3, Y-12	0	0	0	5,000	0
Coordinate Measuring Machine #5, Y-12	0	5,000	0	0	0
Graphite Drying Oven #2, Y-12	5,000	0	0	0	0
Solution Heat Treat Furnace, Y-12	18,000	0	0	0	0
9204-2E High Temperature Ovens (Final Assembly), Y-12	18,000	0	0	0	0
9201-5N Dye Pent/Ultrasonic Tanks, Y-12	0	18,000	0	0	0
Component Canning Box, Y-12	0	0	0	15,000	0
Large Graphite/VTL Lathe #2, Y-12	0	0	0	5,000	0
Large Graphite Lathe #3, Y-12	0	0	0	5,000	0
SNMV Purchase/Replacement, Y-12	0	0	0	2,500	2,500
Total, Capital Equipment (including MIE)	**79,953**	**67,810**	**40,686**	**74,081**	**N/A**
Minor Construction Projects (Total Estimated Cost (TEC)					
Total Minor Construction Projects (TEC <$5M)	31,544	32,237	32,947	33,672	N/A
12-64 Bays 11, 12 & 15 Replacement Facilities, PX	1,300	3,983	0	0	0
Total, Minor Construction Projects	**32,844**	**36,220**	**32,947**	**33,672**	**N/A**
Total, Capital Summary	**112,796**	**104,030**	**73,632**	**107,752**	**N/A**

Production Modernization

Overview

The Production Modernization program is responsible for modernizing the facilities, infrastructure, and equipment that produce materials and components to meet stockpile requirements and maintain the Nation's nuclear deterrent. The program encompasses five major subprograms that sustain the Nation's nuclear weapons stockpile[a]:

1. The Primary Capability Modernization program consolidates management of primary stage material processing and component production capabilities in the National Nuclear Security Administration's (NNSA) nuclear security enterprise. The program includes (1) Plutonium Modernization and (2) High Explosives and Energetics Modernization.
2. The Secondary Capability Modernization program restores and enhances manufacturing capabilities for the secondary stage to required levels in the nuclear security enterprise. This includes ensuring the availability of strategic materials and other sub-component streams necessary for the secondary stage as well as modernizing the facilities and operations required to process these materials, fabricate them into parts, and assemble the final components. The program includes (1) Uranium Modernization, (2) Depleted Uranium Modernization, and (3) Lithium Modernization.
3. The Tritium Modernization and Domestic Uranium Enrichment program consists of two parts: (1) Tritium Modernization produces, recovers, and recycles tritium to support national security requirements and (2) Domestic Uranium Enrichment (DUE) establishes a reliable supply of enriched uranium to support U.S. national security needs.
4. The Non-Nuclear Capability Modernization (NNCM) program provides management and oversight of strategic investments to modernize capabilities for design, qualification, and production of non-nuclear components for multiple weapon systems. The NNCM program provides enhanced capability and capacity to produce and qualify non-nuclear components to meet scheduled stockpile sustainment and weapon modernization programs, as well as development of strategies, processes and new capabilities and programmatic equipment for production of non-nuclear components.
5. The Capability Based Investments (CBI) program executes projects for equipment, tools, supporting facilities, and infrastructure directly related to enduring, multi-program weapon activity capabilities, mission deliverables, and management of programmatic risk across the nuclear security enterprise.

The Production Modernization program does the following:

1. Provides funding for efforts across the nuclear security enterprise to restore the Nation's capability to produce 80 plutonium pits per year (ppy).
2. Enables sustainment and modernization high explosives and energetics infrastructure across the nuclear security enterprise and capabilities necessary for the timely delivery of qualified high explosive, pyrotechnic, and propellant materials to meet current and future stockpile requirements.
3. Provides funding to modernize uranium operations to ensure delivery of secondary components needed to maintain the stockpile as well as provide support to the U.S. Navy and nonproliferation programs.
4. Enables the restart and modernization of lapsed depleted uranium (DU) alloying and component manufacturing capabilities to ensure NNSA can meet short- and long-term mission requirements.
5. Maintains the production of the Nation's enriched lithium supply in support of Defense Programs, the Department of Energy (DOE) Office of Science, the Department of Homeland Security, and other customers.
6. Operates the national capability for producing, recycling, and recovering tritium and is expanding capacity to reliably meet additional national security requirements.
7. Provides funding to modernize capabilities for the production and qualification of non-nuclear components for multiple weapon systems.
8. Provides funding for risk reduction through recapitalization or enhancement of core scientific and manufacturing capabilities.

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[a] Starting in FY 2023 as part of the proposed budget structure, Production Modernization includes Line-item Construction Projects funded in Infrastructure and Operations in previous years that now reside in their respective portfolios for ease of management and transparency, as well as Capability Based Investments (CBI).

Line-Item Construction

Production Modernization line-item construction projects are critical to revitalizing the program-specific capabilities that directly support the nuclear weapons programs. These projects ensure the strategic material industrial base necessary for stockpile modernization is constructed for the nuclear security enterprise and will provide the base materials for component production. These projects will also replace obsolete, unreliable facilities and infrastructure to reduce safety and program risk while improving responsiveness, capacity, and capabilities.

Production Modernization
Funding (Comparable)

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Production Modernization					
Primary Capability Modernization					
Plutonium Modernization					
Los Alamos Plutonium Modernization					
Los Alamos Plutonium Operations	610,599	610,599	767,412	+156,813	+25.7%
21-D-512, Plutonium Pit Production Project, LANL	226,000	226,000	588,234	+362,234	+160.3%
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL	30,000	30,000	30,002	+2	0%
07-D-220-04 Transuranic Liquid Waste Facility, LANL	36,687	36,687	24,759	-11,928	-32.5%
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL	169,427	169,427	162,012	-7,415	-4.4%
Total, Los Alamos Plutonium Modernization	**1,072,713**	**1,072,713**	**1,572,419**	**+499,706**	**+46.6%**
Savannah River Plutonium Modernization					
Savannah River Plutonium Operations	200,000	200,000	58,300	-141,700	-70.9%
21-D-511, Savannah River Plutonium Processing Facility, SRS	241,896	241,896	700,000	+458,104	+189.4%
Total, Savannah River Plutonium Modernization	**441,896**	**441,896**	**758,300**	**+316,404**	**+71.6%**
Enterprise Plutonium Support	90,782	90,782	88,993	-1,789	-2.0%
Total, Plutonium Modernization	**1,605,391**	**1,605,391**	**2,419,712**	**+814,321**	**+50.7%**
High Explosives & Energetics					
High Explosives & Energetics	67,370	67,370	101,380	+34,010	+50.5%
23-D-516, Energetic Materials Characterization Facility, LANL	0	0	19,000	+19,000	0%
21-D-510, HE Synthesis, Formulation, and Production, PX	31,000	31,000	108,000	+77,000	+248.4%
15-D-301 HE Science & Engineering Facility, PX	43,000	43,000	20,000	-23,000	-53.5%
Total, High Explosives & Energetics	**141,370**	**141,370**	**248,380**	**+107,010**	+75.7%
Total, Primary Capability Modernization	**1,746,761**	**1,746,761**	**2,668,092**	**+921,331**	**+52.7%**
Secondary Capability Modernization					
Uranium Modernization	306,689	306,689	297,531	-9,158	-3.0%
Depleted Uranium Modernization	110,915	110,915	170,171	+59,256	+53.4%
Lithium Modernization	39,400	39,400	68,661	+29,261	+74.3%
18-D-690, Lithium Processing Facility, Y-12	109,405	109,405	216,886	+107,481	+98.2%
06-D-141, Uranium Processing Facility, Y-12	750,000	750,000	362,000	-388,000	-51.7%
Total, Secondary Capability Modernization	**1,316,409**	**1,316,409**	**1,115,249**	**-201,160**	**-15.3%**

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Tritium and Domestic Uranium Enrichment					
Tritium Sustainment and Modernization	312,109	312,109	361,797	+49,688	+15.9%
Domestic Uranium Enrichment	160,000	160,000	144,852	-15,148	-9.5%
Uranium Reserve	75,000	75,000	0	-75,000	-100.0%
18-D-650, Tritium Finishing Facility, SRS	27,000	27,000	73,300	+46,300	+171.5%
Total, Tritium and Domestic Uranium Enrichment	**574,109**	**574,109**	**579,949**	**+5,840**	**+1.0%**
Non-Nuclear Capability Modernization					
Non-Nuclear Capability Modernization	107,137	107,137	123,084	+15,947	+14.9%
22-D-513, Power Sources Capability, SNL	0	0	0	0	0%
Total, Non-Nuclear Capability Modernization	**107,137**	**107,137**	**123,084**	**+15,947**	**+14.9%**
Capability Based Investments	**149,117**	**149,117**	**154,220**	**+5,103**	**+3.4%**
Planning for Programmatic Construction (Pre-CD-1)	**10,000**	**10,000**	**0**	**-10,000**	**-100.0%**
Total, Production Modernization	**3,903,533**	**3,903,533**	**4,640,594**	**+737,061**	**+18.9%**

Production Modernization
Outyear Funding

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Production Modernization				
Primary Capability Modernization				
Plutonium Modernization				
Los Alamos Plutonium Modernization				
Los Alamos Plutonium Operations	814,507	820,898	873,846	906,943
21-D-512, Plutonium Pit Production Project, LANL	670,000	660,000	625,000	365,000
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL	30,000	34,475	2,000	0
07-D-220-04 Transuranic Liquid Waste Facility, LANL	8,933	0	0	0
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL	248,917	167,867	0	0
Total, Los Alamos Plutonium Modernization	**1,772,357**	**1,683,240**	**1,500,846**	**1,271,943**
Savannah River Plutonium Modernization				
Savannah River Plutonium Operations	70,000	81,584	120,000	170,000
21-D-511, Savannah River Plutonium Processing Facility, SRS	858,235	1,014,508	1,051,339	952,000
Total, Savannah River Plutonium Modernization	**928,235**	**1,096,092**	**1,171,339**	**1,122,000**
Enterprise Plutonium Support	87,948	94,766	90,365	91,317
Total, Plutonium Modernization	**2,788,540**	**2,874,098**	**2,762,550**	**2,485,260**
High Explosives & Energetics				
High Explosives & Energetics	95,497	85,675	89,747	91,632
23-D-516, Energetic Materials Characterization Facility, LANL	29,000	107,000	136,000	43,000
21-D-510, HE Synthesis, Formulation, and Production, PX	162,000	212,000	96,767	0
15-D-301 HE Science & Engineering Facility, PX	58,356	0	0	0
Total, High Explosives & Energetics	**344,853**	**404,675**	**322,514**	**134,632**
Total, Primary Capability Modernization	**3,133,393**	**3,278,773**	**3,085,064**	**2,619,892**
Secondary Capability Modernization				
Uranium Modernization	372,508	332,534	330,126	337,059
Depleted Uranium Modernization	195,600	197,000	181,000	173,000
Lithium Modernization	44,833	45,820	46,828	47,811
18-D-690, Lithium Processing Facility, Y-12	260,770	280,000	290,000	250,000
06-D-141, Uranium Processing Facility, Y-12	122,589	0	0	0
Total, Secondary Capability Modernization	**996,300**	**855,354**	**847,954**	**807,870**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
	(Dollars in Thousands)			
Tritium and Domestic Uranium Enrichment				
Tritium Sustainment and Modernization	339,173	365,350	352,602	360,007
Domestic Uranium Enrichment	233,262	273,869	307,214	314,355
18-D-650, Tritium Finishing Facility, SRS	92,200	105,700	89,200	66,200
Total, Tritium and Domestic Uranium Enrichment	**664,635**	**744,919**	**749,016**	**740,562**
Non-Nuclear Capability Modernization				
Non-Nuclear Capability Modernization	168,278	141,694	121,566	122,529
22-D-513, Power Sources Capability, SNL	37,886	71,083	43,902	44,824
Total, Non-Nuclear Capability Modernization	**206,164**	**212,777**	**165,468**	**167,353**
Capability Based Investments	**157,071**	**153,597**	**154,658**	**161,896**
Warhead Assembly				
Warhead Assembly Operations	0	0	10,000	15,000
18-D-680 Material Staging Facility, PX	0	0	15,000	100,000
Total, Warhead Assembly	**0**	**0**	**25,000**	**115,000**
Total, Production Modernization	**5,157,563**	**5,245,420**	**5,027,160**	**4,612,573**

Production Modernization
Funding (Non-Comparable)

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Primary Capability Modernization					
Plutonium Modernization					
Los Alamos Plutonium Modernization					
Los Alamos Plutonium Operations	610,599	610,599	767,412	+156,813	+25.7%
21-D-512, Plutonium Pit Production Project, LANL	226,000	226,000	588,234	+362,234	+160.3%
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL	0	0	30,002	+30,002	0%
07-D-220-04 Transuranic Liquid Waste Facility, LANL	0	0	24,759	+24,759	0%
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL	0	0	162,012	+162,012	0%
Total, Los Alamos Plutonium Modernization	**836,599**	**836,599**	**1,572,419**	**+735,820**	**+88.0%**
Savannah River Plutonium Modernization					
Savannah River Plutonium Operations	200,000	200,000	58,300	-141,700	-70.9%
21-D-511, Savannah River Plutonium Processing Facility, SRS	241,896	241,896	700,000	+458,104	+189.4%
Total, Savannah River Plutonium Modernization	**441,896**	**441,896**	**758,300**	**+316,404**	**+71.6%**
Enterprise Plutonium Support	90,782	90,782	88,993	-1,789	-2.0%
Total, Plutonium Modernization	**1,369,277**	**1,369,277**	**2,419,712**	**+1,050,435**	**+76.7%**
High Explosives & Energetics					
High Explosives & Energetics	63,620	63,620	101,380	+37,760	+59.4%
HESE OPCs	3,750	3,750	0	-3,750	-100.0%
23-D-516, Energetic Materials Characterization Facility, LANL	0	0	19,000	+19,000	0%
21-D-510, HE Synthesis, Formulation, and Production, PX	0	0	108,000	+108,000	0%
15-D-301 HE Science & Engineering Facility, PX	0	0	20,000	+20,000	0%
Total, High Explosives & Energetics	**67,370**	**67,370**	**248,380**	**+181,010**	**+268.7%**
Total, Primary Capability Modernization	**1,436,647**	**1,436,647**	**2,668,092**	**+1,231,445**	**+85.7%**
Secondary Capability Modernization					
Uranium Sustainment	242,732	242,732	0	-242,732	-100.0%
Uranium Modernization	0	0	297,531	+297,531	0%
Process Technology Development	63,957	63,957	0	-63,957	-100.0%
Depleted Uranium Modernization	110,915	110,915	170,171	+59,256	+53.4%
Lithium Modernization	39,400	39,400	68,661	+29,261	+74.3%
18-D-690, Lithium Processing Facility, Y-12	0	0	216,886	+216,886	0%
06-D-141, Uranium Processing Facility, Y-12	0	0	362,000	+362,000	0%
Total, Secondary Capability Modernization	**457,004**	**457,004**	**1,115,249**	**+658,245**	**+144.0%**

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
	(Dollars in Thousands)				
Tritium and Domestic Uranium Enrichment					
Tritium Sustainment and Modernization	312,109	312,109	361,797	+49,688	+15.9%
Domestic Uranium Enrichment	70,000	70,000	144,852	+74,852	+106.9%
HEU Downblend	90,000	90,000	0	-90,000	-100.0%
Uranium Reserve	75,000	75,000	0	-75,000	-100.0%
18-D-650, Tritium Finishing Facility, SRS	0	0	73,300	+73,300	0%
Total, Tritium and Domestic Uranium Enrichment	**547,109**	**547,109**	**579,949**	**+32,840**	**+6.0%**
Non-Nuclear Capability Modernization					
Non-Nuclear Capability Modernization	107,137	107,137	123,084	+15,947	+14.9%
22-D-513, Power Sources Capability, SNL	0	0	0	0	0%
Total, Non-Nuclear Capability Modernization	**107,137**	**107,137**	**123,084**	**+15,947**	**+14.9%**
Capability Based Investments	**0**	**0**	**154,220**	**+154,220**	**0%**
Total, Production Modernization	**2,547,897**	**2,547,897**	**4,640,594**	**+2,092,697**	**+82.1%**

Production Modernization
Outyear Funding

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Primary Capability Modernization				
Plutonium Modernization				
Los Alamos Plutonium Modernization				
Los Alamos Plutonium Operations	814,507	820,898	873,846	906,943
21-D-512, Plutonium Pit Production Project, LANL	670,000	660,000	625,000	365,000
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL	30,000	34,475	2,000	0
07-D-220-04 Transuranic Liquid Waste Facility, LANL	8,933	0	0	0
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL	248,917	167,867	0	0
Total, Los Alamos Plutonium Modernization	**1,772,357**	**1,683,240**	**1,500,846**	**1,271,943**
Savannah River Plutonium Modernization				
Savannah River Plutonium Operations	70,000	81,584	120,000	170,000
21-D-511, Savannah River Plutonium Processing Facility, SRS	858,235	1,014,508	1,051,339	952,000
Total, Savannah River Plutonium Modernization	**928,235**	**1,096,092**	**1,171,339**	**1,122,000**
Enterprise Plutonium Support	87,948	94,766	90,365	91,317
Total, Plutonium Modernization	**2,788,540**	**2,874,098**	**2,762,550**	**2,485,260**
High Explosives & Energetics				
High Explosives & Energetics	89,710	83,710	89,747	91,632
HESE OPCs	5,787	1,965	0	0
23-D-516, Energetic Materials Characterization Facility, LANL	29,000	107,000	136,000	43,000
21-D-510, HE Synthesis, Formulation, and Production, PX	162,000	212,000	96,767	0
15-D-301 HE Science & Engineering Facility, PX	58,356	0	0	0
Total, High Explosives & Energetics	**344,853**	**404,675**	**322,514**	**134,632**
Total, Primary Capability Modernization	**3,133,393**	**3,278,773**	**3,085,064**	**2,619,892**
Secondary Capability Modernization				
Uranium Modernization	372,508	332,534	330,126	337,059
Depleted Uranium Modernization	195,600	197,000	181,000	173,000
Lithium Modernization	44,833	45,820	46,828	47,811
18-D-690, Lithium Processing Facility, Y-12	260,770	280,000	290,000	250,000
06-D-141, Uranium Processing Facility, Y-12	122,589	0	0	0
Total, Secondary Capability Modernization	**996,300**	**855,354**	**847,954**	**807,870**

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Tritium and Domestic Uranium Enrichment				
Tritium Sustainment and Modernization	339,173	365,350	352,602	360,007
Domestic Uranium Enrichment	233,262	273,869	307,214	314,355
18-D-650, Tritium Finishing Facility, SRS	92,200	105,700	89,200	66,200
Total, Tritium and Domestic Uranium Enrichment	**664,635**	**744,919**	**749,016**	**740,562**
Non-Nuclear Capability Modernization				
Non-Nuclear Capability Modernization	168,278	141,694	121,566	122,529
22-D-513, Power Sources Capability, SNL	37,886	71,083	43,902	44,824
Total, Non-Nuclear Capability Modernization	**206,164**	**212,777**	**165,468**	**167,353**
Capability Based Investments	**157,071**	**153,597**	**154,658**	**161,896**
Warhead Assembly				
Warhead Assembly Operations	0	0	10,000	15,000
18-D-680, Material Staging Facility, PX	0	0	15,000	100,000
Total, Warhead Assembly	**0**	**0**	**25,000**	**115,000**
Total, Production Modernization	**5,157,563**	**5,245,420**	**5,027,160**	**4,612,573**

Production Modernization
Explanation of Major Changes
(Dollars in Thousands)

	FY 2023 Request vs FY 2021 Enacted ($)
Production Modernization	
Plutonium Modernization	
Los Alamos Plutonium Modernization	
Los Alamos Plutonium Operations Increase supports a ramp in engineering evaluations and certification activities to produce the first war reserve (WR) plutonium pit in concert with increased equipment purchases/installation activities and the hiring, training, and qualification of additional staff to support WR pit production ramp up.	**+156,813**
21-D-512, Plutonium Pit Production Project, LANL Increase allows for the establishment of a performance baseline for the Decontamination and Decommissioning subproject; approval of long-lead equipment and enclosure procurements for the 30 ppy Base Equipment Installation subproject; and, updates to acquisition/tailoring to the remainder of the subprojects at Los Alamos National Laboratory's (LANL) Plutonium Facility (PF)-4.	**+362,234**
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL No significant change.	**+2**
17-D-220-04, Transuranic Liquid Waste Facility, LANL Decrease reflects the revised Critical Decision 2/3 funding profile and the use of carryover to execute construction activities.	**-11,928**
04-D-125, Chemistry and Metallurgy Research Replacement, Project, LANL Decrease reflects use of carryover to align with design and construction estimates for the RC3 and PEI2 subprojects.	**-7,415**
Savannah River Plutonium Modernization **Savannah River Plutonium Operations** Decrease is due to June 2021 CD-1 package approval outlining adjusted CD-4 timeline and associated delay in Savannah River Site (SRS) Program Office staffing and activity ramp up.	**-141,700**
21-D-511, Savannah River Plutonium Processing Facility, SRS Increase supports 90 percent design maturation for CD-2 (Approve Performance Baseline) of Savannah River Plutonium Processing Facility (SRPPF) as well as demolition and removal, bulk material buys, and equipment purchases.	**+458,104**

	FY 2023 Request vs FY 2021 Enacted ($)
Enterprise Plutonium Support	**-1,789**
Decrease accounts for reduced certification activities as the program reaches the First Production Unit (FPU) of a WR pit at LANL.	
High Explosives and Energetics	
High Explosives and Energetics	**+34,010**
Increase supports establishment of a high explosives production capability at the Naval Surface Warfare Center Indian Head Division (NSWC IHD) by FY 2026 to increase schedule confidence for qualified PPI, QE, and WR LX-17 lots. Additionally, increase supports pilot plant parameter studies at Pantex and Lawrence Livermore National Laboratory (LLNL) to achieve LX-17 qualified material production for the W87-1 and future weapon systems. Increase also reflects the increased HE Science and Engineering Facility (HESE) OPC need in FY 2023.	
23-D-516, Energetic Materials Characterization Facility, LANL	**+19,000**
Increase required to begin preliminary design activities.	
21-D-510, HE Synthesis, Formulation, and Production, PX	**+77,000**
Increase required to start construction activities to include site preparation approval and long-lead procurements.	
15-D-301, HE Science and Engineering Facility, PX	**-23,000**
Decrease reflects use of carryover for construction activities. FY 2023 funding will be used for construction with on-site mobilization, and to execute main works construction contract.	
Secondary Capability Modernization	
Uranium Modernization	**-9,158**
Uranium Sustainment and Process Technology Development funding lines have been consolidated into Uranium Modernization due to synergies within the scope associated with each program. The decrease reflects transition from procurement and installation towards startup and commissioning activities for Electrorefining and Calciner projects.	
06-D-141, Uranium Processing Facility, Y-12	**-388,000**
Decrease reflects transition from peak construction activities towards startup and commissioning activities.	
Depleted Uranium Modernization	**+59,256**
Increase reflects investment in critical foundry modernization projects and activities to support Binary ingot production. Funding also accounts for executing scope to modernize the historical wrought process to meet component manufacturing demand and mitigate reliability risks amongst other program activities planned to be executed in FY 2023, such as the DU Bridging Strategy.	

	FY 2023 Request vs FY 2021 Enacted ($)
Lithium Modernization	**+29,261**
Increase to fully fund minor construction projects such as the Lithium Lab Area Upgrades, Backup Crusher/Grinder project, and the Lithium Process Equipment Relocation risk reduction activity.	
18-D-690, Lithium Processing Facility, Y-12	**+107,481**
Increase supports long-lead procurements and site preparation.	
Tritium and Domestic Uranium Enrichment	
Tritium Sustainment and Modernization	**+49,688**
Increase supports tritium production requirements, licensing Tennessee Valley Authority (TVA) reactors beyond 1,792 TPBARs, Spent Fuel Pool Rerack, Hot and Cold Nitrogen Replacement.	
18-D-650, Tritium Finishing Facility, Y-12	**+46,300**
Increase reflects an increase in activity to improve the design schedule and in activities to support obtaining CD-2/3 in FY 2024 for the Site Preparation and Warehouse subproject	
Domestic Uranium Enrichment	**-15,148**
Decrease reflects combining HEU down-blending into the Domestic Uranium Enrichment line. Decrease reflects use of carryover for down-blending activities, offset by increases for centrifuge development as the program advances towards larger-scale research and development (R&D) demonstrations.	
Uranium Reserve	**-75,000**
Decrease reflects that funding for the Uranium Reserve is not requested in FY 2023 under the Tritium and Domestic Uranium Enrichment program.	
Non-Nuclear Capability Modernization	**+15,947**
Increase reflects the transfer of scope for Accelerator and Major Environmental Test Facility programmatic equipment maintenance requirements from I&O and includes additional support for required qualification and testing capabilities including modernization efforts for the radiation testing facility Annular Core Research Reactor (ACRR) at Sandia National Laboratories (SNL). Increase also supports the Tester Transformation Initiative at SNL to improve tester requirements by establishing a means for pre-qualifying testers to a common DA/PA platform and ensures that designs and hardware meet requirements. Increase also reflects direct funding for At-Risk Materials, an enterprise-wide effort for early identification of at-risk-materials and development of solutions to avoid mission supply chain interruptions.	

	FY 2023 Request vs FY 2021 Enacted ($)
Capability Based Investments Increase reflects the expansion of the Flexible Production Capacity Initiative to eliminate excess programmatic equipment to free up floor space, and address known space shortfalls.	**+5,103**
Planning for Programmatic Construction Decrease reflects the shift to account for pre-CD-1 funds at the program level to more directly allocate other project cost (OPC) funds to prioritized projects rather than at the Defense Programs level.	**-10,000**
Total, Production Modernization	**+737,061**

Production Modernization
Primary Capability Modernization

Overview

The Primary Capability Modernization program consolidates management of primary stage material processing and component production capabilities in the NNSA nuclear security enterprise. The program includes (1) Plutonium Modernization and (2) High Explosives and Energetics Modernization.

Description

The Plutonium Modernization program provides funding for efforts across the nuclear security enterprise to restore the Nation's capability to produce 80 pits per year (ppy). NNSA will continue to provide additional details regarding Plutonium Modernization activities to Congressional staff through quarterly pit production briefings, as required by the FY 2020 Energy and Water Development and Related Agencies Appropriations Act. NNSA remains committed to achieving the statutory pit production capability goals on the path to 80 ppy, including the capability to produce not less than 30 pits during 2026 at LANL.

Plutonium Modernization activities include the following:

- **Los Alamos Plutonium Modernization**: Activities include Los Alamos Plutonium Operations, which provides for the operational expenses needed to meet pit production requirements at LANL, including activities to hire, train, qualify, and retain required pit production personnel; recapitalization of equipment for WR pit production; pit production process qualification and certification activities; tooling design and fabrication; and Plutonium Modernization's share of operational expenses for PF-4. This funding also supports manufacturing of precision plutonium devices for science-related evaluation. In FY 2023, LANL will continue process qualification and certification activities to produce the first WR pit. LANL Plutonium Operations also provides funding for key support services and safety management programs in PF-4, including a radiological control program, facility and equipment maintenance, a criticality safety program, shipping and receiving, authorization basis, work control documentation, training and qualification, waste management, material handling and storage, and facility availability to maintain plutonium capabilities.

  Activities within Los Alamos Plutonium Modernization also include the Los Alamos Plutonium Pit Production Project, 21-D-512. This project will manage capital acquisitions required to increase production capacity at PF-4 to no fewer than 30 ppy, as well as associated infrastructure investments at LANL to support pit production. FY 2023 funding will support efforts to mature design documentation, continue removal of legacy equipment in PF-4, and install new production equipment.

  The TA-55 Reinvestment Project, Phase 3, 15-D-302 funding will continue construction activities to modernize fire alarm panels providing a vital safety function in PF-4.

  The Transuranic Liquid Waste Facility (TLW), 07-D-220-04 funding will support the construction of a new hazard category 3 nuclear facility to house processing equipment capable of treating transuranic (TRU) liquid waste, a TRU liquid influent storage, and necessary utilities.

  The Chemistry and Metallurgy Research Replacement Project, 04-D-125 funding will be used to continue design on the PEI2 and RC3 subprojects and construction/procurement of long-lead items including the Post 118 secure entrance to PF-4 and nearby change rooms that service programmatic personnel working in the facility. Funding in FY 2023 for PEI2 will support construction activities to improve TA-55 and PF-4 personnel and vehicular ingress/egress, levels of worker preparation/staging and warehousing for relocated AC/MC operations and personnel, and design work for equipment installation. FY 2023 funds for the RC3 subproject will continue design work to support CD-2/3 for equipment in 3Q FY 2025 and construction of a small office building and warehouse.

- **Savannah River Plutonium Modernization**: Supports the establishment of a program office at SRS to enable pit production development efforts, train and hire future production staff, and support future production and operations planning. Until an appropriate training center is fully operational, SRS will use existing facilities at both SRS and LANL to support training activities.

Additionally, the Savannah River Plutonium Processing Facility (SRPPF) project, 21-D-511, repurposes the partially completed Mixed Oxide Fuel Fabrication Facility (MFFF) to achieve a production capability of 50 ppy consistent with the NNSA's recommended alternative for pit production. FY 2023 activities focus on maturing the design of the main process building, which includes production equipment and gloveboxes, safety systems, facility utilities, and support infrastructure. Other supporting activities will continue to focus on design of subprojects for utilities/site preparation, administrative buildings, and the training center.

- **Enterprise Plutonium Support:** Provides funding for activities that support pit production across the nuclear security enterprise, including Kansas City National Security Campus production of non-nuclear components, certification activities, management of the plutonium pit Product Realization Team (PRT) at Lawrence Livermore National Laboratory (LLNL), and material management activities at the Nevada National Security Site (NNSS).

Highlights of the FY 2023 Budget Request

- Support pit production capability modernization in accordance with Department of Defense requirements.
- Qualify pit production processes and perform certification tests to produce the first WR pit.
- Continue investments to install additional production equipment and recapitalize end-of-life equipment in PF-4 to reduce pit production mission risk.
- Continue hiring, training, and qualifying staff to ramp up future pit production.
- Improve PF-4 vault facilities efficiency through inventory work-off and optimization of footprint to support the transition to plutonium production and improve Material at Risk (MAR) posture.
- Provide storage/staging and inventory management capabilities in support of the plutonium pit production mission.
- Continue to mature the new SRS Plutonium Operations program to include expanded knowledge transfer and training.
- Continue efforts to mature the design of the SRPPF project.
- Obtain CD-2/3 for West Entry Control Facility Subproject (WECF) as part of LAP4.

FY 2024 – FY 2027 Key Milestones

- Achieve 10 pits per year production capability (2024).
- Achieve 30 pits per year production capability (2026).
- Obtain CD-2/3 for SRPPF (2024).

FY 2021 Accomplishments

- Produced pits in PF-4 successfully to support process qualification and product certification enabling WR pit production to begin in 2023.
- Installed equipment in PF-4 to support increased production.
- Improved Transuranic (TRU) waste management and characterization capabilities to support safe and efficient TRU waste disposition at LANL.
- Executed material movements at NNSS in support of plutonium pit production mission.
- Deployed 15 SRS personnel to LANL as part of the expanding Knowledge Transfer initiative.
- Obtained LAP4 CD-1 approval in April 2021.
- Obtained SRPPF CD-1 approval in June 2021.
- Obtained TRP-III CD-1/2/3 approval in May 2021.
- Achieved PEI1 subproject (04-D-125-05) CD-4 approval in January 2021, more than one year ahead of schedule.

Plutonium Modernization

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Plutonium Modernization $1,605,391,000	**Plutonium Modernization $2,419,712,000**	**Plutonium Modernization +$814,321,000**
Los Alamos Plutonium Modernization $1,072,713,000	***Los Alamos Plutonium Modernization $1,572,419,000***	***Los Alamos Plutonium Modernization +$499,706,000***
Los Alamos Plutonium Operations $610,599,000	***Los Alamos Plutonium Operations $767,412,000***	***Los Alamos Plutonium Operations +$156,813,000***
• Maintained base personnel while adding additional personnel to ramp up work and sustain pit-manufacturing capability. • Continued to recapitalize end-of-life equipment vital to the pit manufacturing mission. • Invested in personnel and equipment needed to support pit production. • Produced pits for the Process Prove-in (PPI) phase of product realization. • Continued design agency qualification of production processes through engineering evaluations. • Continued to recover, recycle, and disposition nuclear materials in support of pit production mission at LANL. • Continued CMR de-inventory of legacy special nuclear material in accordance with the CMR Facility Exit Plan. • Provided safe and secure storage, disposition, and management of nuclear materials in support of plutonium missions at LANL.	• Maintain base personnel while adding additional personnel to ramp up work and sustain pit-manufacturing capability. • Continue to recapitalize end-of-life equipment vital to the pit manufacturing mission. • Continue engineering evaluation of processes and conduct pit certification activities. • Produce FPU of a WR pit. • Provide safe and secure storage and staging capabilities, management of nuclear materials and disposition planning (including analysis, forecasting, and modeling) in support of plutonium missions at LANL. • Continue to recover, recycle, and to disposition programmatic nuclear materials in support of pit production mission at LANL. • De-inventory legacy special nuclear material at CMR, including analytical sample reserves, in accordance with the CMR Facility Exit Plan. • Provide safe and secure storage, disposition, and management of nuclear materials in support of plutonium missions at LANL. • Continue support of TRP-III and TLW OPCs.	• Increase includes costs for increased hiring and expanded production to support of reaching FPU.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
21-D-512 Plutonium Pit Production Project, LANL $226,000,000	***21-D-512 Plutonium Pit Production Project, LANL $588,234,000***	***21-D-512 Plutonium Pit Production Project, LANL +$362,234,000***
• Developed design documentation to complete CD-1 and advance toward CD-2. • Pursued long-lead procurements. • Conducted facility and site preparation.	• Complete design documentation for WECF and Training Facility. • Achieve CD-2/3 for multiple subprojects. • Continue pursuing long-lead procurements. • Install equipment to expand pit production capacity in PF-4.	• Increase reflects start of construction on multiple subprojects.
15-D-302 TA-55 Reinvestments Project, Phase 3, LANL $30,000,000	***15-D-302 TA-55 Reinvestments Project, Phase 3, LANL $30,002,000***	***15-D-302 TA-55 Reinvestments Project, Phase 3, LANL +$2,000***
• Continued to extend the life of TA-55 by recapitalizing and revitalizing an aging and obsolete fire alarm system.	• Continue construction activities.	• No significant change
07-D-220-04, Transuranic Liquid Waste Facility, LANL $36,687,000	***07-D-220-04, Transuranic Liquid Waste Facility, LANL $24,759,000***	***07-D-220-04, Transuranic Liquid Waste Facility, LANL -$11,928,000***
• Continued to execute activities associated with a new hazard category 3 nuclear facility to house processing equipment capable of treating at least 29,000 liters of transuranic (TRU) liquid waste each year, a TRU liquid influent storage, and necessary utilities.	• Restart construction activities.	Decrease reflects the revised Critical Decision 2/3 funding profile and the use of carryover to execute construction activities
04-D-125 Chemistry and Metallurgy Research Replacement Project, LANL $169,427,000	***04-D-125 Chemistry and Metallurgy Research Replacement Project, LANL $162,012,000***	***04-D-125 Chemistry and Metallurgy Research Replacement Project, LANL -$7,415,000***
• Provided continuity in analytical chemistry (AC) and materials characterization (MC) capabilities through the relocation of programmatic operations from the existing CMR facility and provides infrastructure and support facilities for consolidated operations at the TA-55 site.	• Obtain CD-2/3A on PEI2 infrastructure projects. • Obtain CD-3A for long-lead procurement items. • Continue construction of ingress and egress facilities and design activities for equipment installation.	• Decrease reflects use of carryover to align with design and construction estimates for RC3 and PEI2 subprojects.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Savannah River Plutonium Modernization $441,896,000	***Savannah River Plutonium Modernization $758,300,000***	***Savannah River Plutonium Modernization +$316,404,000***
Savannah River Plutonium Operations $200,000,000	***Savannah River Plutonium Operations $58,300,000***	***Savannah River Plutonium Operations -$141,700,000***
• Continued establishing and staffing a program office at SRS to support project and future production activities. • Completed conceptual design to achieve CD-1.	• Continue to mature SRS program office to support future production activities. • Hire and train staff.	• FY 2021 budget included pre-CD-1 OPC funding for SRPPF • Decrease aligns budget based on adjusted Operations requirements after approval of CD-1.
21-D-511 Savannah River Plutonium Processing Facility, SRS $241,896,000	***21-D-511 Savannah River Plutonium Processing Facility, SRS $700,000,000***	***21-D-511 Savannah River Plutonium Processing Facility, SRS +$458,104,000***
• Continued site preparatory work. • Began long lead procurements, including gloveboxes. • Completed conceptual design to achieve CD-1. • Began planning and design on high fidelity training facility design. • Matured preliminary design to advance toward CD-2.	• Execute long lead procurement, demolition and removal (D&R), and site preparation activities. • Support design maturation in anticipation of CD-2.	• Increase aligns budget based on CD-1 approval and CD-4 timeline.
Enterprise Plutonium Support $90,782,000	***Enterprise Plutonium Support $88,993,000***	***Enterprise Plutonium Support -$1,789,000***
• Continued LLNL certification activities associated with pit production. • Continued Kansas City National Security Campus (KCNSC) non-nuclear component production. • Supported Product Realization Team management at LLNL. • Executed material management and storage activities at NNSS.	• Continue LLNL certification activities associated with pit production to enable FPU of a WR pit at LANL in 2023. • Continue KCNSC non-nuclear component production. • Continue to support PRT management at LLNL. • Execute material management activities at NNSS.	• Reduction in funding based on reduced amount of certification activities necessary post FPU.

Primary Capability Modernization
High Explosives and Energetics

Description

The High Explosives and Energetics (HE&E) program focuses on modernization and prioritization of High Explosives (HE) processing facilities and qualification of high explosive, pyrotechnic, and propellant materials for supplying the nuclear security enterprise across five M&O sites (Pantex Plant, SNL, LANL, LLNL, and NNSS). The HE&E program enables the production of HE and energetic materials required for an effective stockpile including the main charge, boosters, detonators, actuators, timer/drivers, spin rockets, and the materials necessary to achieve nuclear weapon safety and security.

Each site maintains multiple dispersed facilities dually capable of performing Research, Development, Test, and Evaluation (RDT&E) and production operations, for example, main charges at Pantex, detonators at LANL, spin rocket motors at SNL, novel HE formulations at LLNL, and large-scale test operations at NNSS.

The HE&E program manages the capital investment of the HE&E infrastructure and equipment to modernize manufacturing capabilities in aging facilities and provide efficiencies in material processing to make a safer working environment. Through active supply chain management and modernization projects, the HE&E program ensures the infrastructure and vendor base is in place to meet tight material production requirements to sustain and modernize the stockpile.

The High Explosive Synthesis, Formulation, and Production Facility (HESFP) at Pantex, and prototype HE manufacturing capability at NSWC IHD will hedge against current HE production and testing capability gaps. The Energetics Materials Characterization (EMC) project is required to support future HE mission requirements for HE synthesis and analytical characterization activities at LANL. The HE&E program ensures that materials and capabilities, such as main charge material development, procurement, and characterization, are available and efficient to ensure a safe, secure, and effective stockpile as NNSA continues to modernize the stockpile to meet nuclear deterrent requirements.

The HE&E modernization program will do the following:

1. Manage the HE&E supply chain risk portfolio to ensure an internal nuclear security enterprise and external vendor base to maintain, manufacture, and deploy Mark Quality HE and energetics in support of weapons production.
2. Define and monitor the qualification standards of HE and energetic material.
3. Support the future development and production of novel HE and energetic material.
4. Define and ensure infrastructure capital investment strategies meet both HE&E material and component requirements to sustain and modernize the stockpile.

Highlights of the FY 2023 Budget Request

- Procure energetic material to meet development and qualification needs of the W87-1.
- Assess production modernization and programmatic equipment priorities across the HE&E enterprise to include additive manufacturing from lab pilot to production, radiography/assembly operations at LANL and NNSS, energetics enclaves at LLNL, energetics manufacturing at SNL, and advanced fabrication at Pantex.
- Stabilize the supply chain and enable material/manufacturing maturation, where needed, to meet the energetic material requirements of the current and future stockpile modernization programs.
    - Re-establish the production capability for titanium/potassium perchlorate (TKP) for ignitor production.
    - Complete work to develop a new hexanitrostilbene 1 qualification testing order to qualify future production of timer drivers for Neutron Generator production.
    - Further develop PBX-9751 as a candidate for future main charge production.
- Provide guidance and contract support for programmatic activities to obtain CD-3A for the HESFP.
- Begin preliminary design activities for the Energetics Material Characterization with a path to final design and CD-2/3.
- Obtain and demonstrate a new capability for insensitive high explosives qualification to hostile impulse environments by completing construction of a full-scale testing environment at SNL with a transition to readiness in FY 2024.
- Complete Insensitive High Explosive (IHE) qualification capability recapitalization at LLNL Site 300 to meet W80-4 IHE qualification deliverables.

- Begin High Explosives production concept, facility, equipment, and automation design at the NSWC-IHD to establish reliable IHE production capability for LX-17 to support main charge FPU in FY 2029.
- Conduct pilot scale TATB synthesis and LX-17 formulation characterization to ensure LX-17 specification is realized in time for HESFP commissioning.
- Complete infrastructure upgrades to LLNL TATB synthesis pilot plant to support PBX-9502 specification development.
- Complete legacy LX-17 qualification to mitigate Holston Army Ammunition Plant production delays.
- Conduct LX-17 development and characterization for the W87-1.
- Demonstrate the nuclear security enterprise's ability to manufacture titanium subhydride ($TiH_{1.65}$) through an advance equilibrium process to reconstitute titanium subhydride potassium perchlorate (THKP) production.

FY 2024 – FY 2027 Key Milestones
- Achieve CD-4 approval for HESE.
- Achieve CD-2/3 approval for HESFP (working to accelerate into FY 2023).
- Obtain CD-2/3 approval for EMC.
- Achieve WR production of PBX-9502 for the W80-4.
- Achieve WR production requirements out of NSWC IHD.
- Obtain material specification for LX-17 high explosive for the W87-1.
- Conduct the first full scale live-HE system vulnerability test simulating a cold x-ray environment.

FY 2021 Accomplishments
- Completed specification for Triaminotrinitrobenzene (TATB)/polymer-bonded explosives (PBX)-9502.
- Achieved CD-1 and awarded the preliminary and final design contract for HESFP.
- Redefined the machining parameters for NNSA Explosive Safety Committee review to decrease machining times.
- Completed Analysis of Alternatives in January 2021 for the EMC facility.
- Reduced identified risks to supply chains by completing third party testing to enable permanent shipping authorization of TKP-OP, TKP-IP, and THKP in support of W80-4 actuator production.
- Made significant progress towards reestablishing synthesis formulation of key IHE material components to be used in future Life Extension Programs (LEP).
- Obtained approval from the proponent organizations for revisions to IHE material and IHE subassembly qualification test description and criteria.
- Supported the procurement and installation of a stainless-steel filter press at the Holston Army Ammunition Plant to enable higher levels of production within EPA limits and provide the correct gradation of TATB material required for NNSA specifications.
- Coordinated the return of LX-17 machine cutting from Holston Army Ammunition Plant as a means of ensuring a viable mitigation plan for the W87-1 main charge material requirements.
- Completed the Development Lot N1 and N2 of PBX 9502 for the B61-12, consisting of 7,500 lbs. total, at Holston Army Ammunition Plant.
- Completed the Development lot 2 and 3 of PBX-9502 for the W80-4, consisting of 9,000 lbs. total, at Holston Army Ammunition Plant.
- Completed an independent review to inform the implementation of a new capability for IHE qualification to hostile impulse requirements at full scale.
- Partnered with the DoD for additional upgrades to Holston Army Ammunition Plant (HSAAP) to further reduce toluene emissions and enable additional TATB production for both the DoD and DOE.

High Explosives and Energetics

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
High Explosives and Energetics $67,370,000	**High Explosives and Energetics $101,380,000**	**High Explosives and Energetics +$34,010,000**
• Consolidated the supply chain and procurements of HE&E to be managed by one program. • Facilitated modernization of the HE&E infrastructure across the nuclear security enterprise. • Established a modern and robust production and manufacturing capability. • Enhanced Mark Quality production for next generation explosive components and materials at SNL. • Provided guidance for energetics surveillance, weapon response, transportation, containers, and explosive/electrical environments. • Supported OPCs for the HESE Line-Item Project. • Supported the JASONs Summer Study on High Explosives Manufacturing Science.	• Continue to facilitate modernization of the HE&E infrastructure across the nuclear security enterprise. • Achieve CD-3A for HESFP at Pantex to initiate early works and procurement of long lead items. • Continue to establish a modern and robust production and manufacturing capability. • Continue to enhance Mark Quality production for next generation explosive components and materials at SNL. • Continue to provide guidance for energetics surveillance, weapon response, and explosive/electrical environments. • Produce high explosive material (LX-17 and LX-21) for the W87-1 program, reconstitute TKP-IP for energetic ignitors, process-prove-in PBX-9502 for the B61-12 and qualify PBX-9502 for the W80-4. • Begin high explosives production work at the NSWC-IHD. • Begin pilot plant parameter studies at Pantex and LLNL. • LX-17 specification development.	• Increase required to manage inflation to support sustainment, qualification, and modernization activities, including material production and infrastructure efforts, to maintain and modernize the stockpile • Increase includes funding for facility design at the NSWC-IHD. • Increase includes Interface Requirements Agreement (IRA) work at Pantex, SNL, and LLNL, including increased material costs and pilot plant parameter studies. • Increase to cover the current OPC need in FY 2023.
23-D-516 Energetic Materials Characterization Facility, LANL $0	***23-D-516 Energetic Materials Characterization Facility, LANL $19,000,000***	***23-D-516 Energetic Materials Characterization Facility, LANL +$19,000,000***
• N/A	• Complete preliminary design activities including conducting a phased 30%, 60%, 90%, 100% design development. • Complete DOE 413. 3b activities in preparation for a CD-2/3 decision.	• Supports preliminary design activities and preparation for a CD-2/3 decision.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
21-D-510 HE Synthesis, Formulation, and Production, PX $31,000,000	***21-D-510 HE Synthesis, Formulation, and Production, PX $108,000,000***	***21-D-510 HE Synthesis, Formulation, and Production, PX +$77,000,000***
• Continue design activities. • Begin post-CD-1 activities	• Complete final design. • Begin construction activities including implementing CD-3A requirements to approve site preparation and long-lead procurements.	• Increase required to begin construction activities.
15-D-301, HE Science and Engineering Facility, PX $43,000,000	***15-D-301, HE Science and Engineering Facility, PX $20,000,000***	***15-D-301, HE Science and Engineering Facility, PX -$23,000,000***
• Complete preliminary design activities.	• Complete final site preparation. • Begin construction with on-site mobilization. • Execute main works construction contract.	• Decrease reflects use of carryover to execute construction activities.

Production Modernization
Secondary Capability Modernization

Overview
The Secondary Capability Modernization program is responsible for restoring and increasing manufacturing capabilities for the secondary stage of nuclear weapons in the nuclear security enterprise. This includes ensuring the availability of strategic materials and other sub-component material streams that are managed by NNSA as well as modernizing the facilities and operations required to process these materials, fabricate, and assemble the final components. The program includes (1) Uranium Modernization (formerly Uranium Sustainment), (2) Depleted Uranium Modernization, (3) Lithium Modernization, (4) the Lithium Processing Facility (LPF), and (5) the Uranium Processing Facility (UPF).

Secondary Capability Modernization
Uranium Modernization

Description

The Uranium Modernization program provides funding to modernize enriched uranium operations to ensure delivery of secondary components needed to maintain the stockpile and support Naval Nuclear Propulsion Program and Nonproliferation programs.

Building 9212 at Y-12, which is more than 75 years old, contains the most hazardous enriched uranium operations and does not meet modern nuclear safety and security standards. The Uranium Modernization program implements elements of NNSA's Uranium Mission Strategy associated with decreasing mission dependency on Building 9212. This requires sustained resources across a multi-year period to systematically plan and execute all phases of this effort. Uranium Modernization specifically supports the transition of Building 9212 capabilities into existing facilities and the Uranium Processing Facility (UPF) as well as implementation of a coordinated transition strategy to end production operations in Building 9212 and begin post-operations deactivation and transition activities.

UPF will provide new floor space for enriched uranium casting, special oxide, and salvage capabilities. The UPF project includes a Main Process Building (MPB), Salvage and Accountability Building (SAB), Mechanical Electrical Building (MEB), Process Support Facilities (PSF), and various other support facilities. Constructing multiple facilities allows each facility to be designed and constructed with a level of safety and security appropriate for the hazards of each operation. UPF was baselined in March of 2018 for $6,500,000,000. FY 2023 funding supports construction of the Main Process Building (MPB), Salvage and Accountability Building (SAB), and Process Support Facilities (PSF) subprojects.

The program also leverages capability relocations to modernize existing enriched uranium capabilities through the development and deployment of new technologies to reduce cost and improve manufacturing processes for nuclear weapon materials. These new technologies improve on existing Building 9212 capabilities by shortening production schedules, reducing risks, and enhancing personnel safety. For example, casting operations in UPF will use microwave technology, replacing the current vacuum induction melt process in Building 9212. The installation and operation of systems moving to enduring facilities will allow for the current high-hazard processes for producing purified uranium metal, processing low equity material, and processing uranium chips/turnings to be shut down.

Uranium Modernization manages material inventories to maintain improved safety posture and optimize composition of the inventory. Program funding also supports investments to extend the operational life of Y-12's Buildings 9215, 9204-2E and 9995. These two efforts will allow for safe and secure operations, including those relocated from Building 9212, in existing facilities through the 2040s. Uranium Modernization also implements a strategy to optimize limited space in the enriched uranium facilities to improve NNSA's responsiveness and resiliency for potential future production requirements.

The program also optimizes the utilization of Y-12's Building 9212 resources to supply the current stockpile with purified enriched uranium metal through 2023, while supporting the transition of new capabilities (e.g., Microwave Casting, Electrorefining, and Direct Chip Melt) into the new and enduring facilities. The program also provides a comprehensive storage capability to support a steady supply stream of material through peak production periods.

Highlights of the FY 2023 Budget Request

- Continue activities that will allow NNSA to phase out mission dependency on Building 9212 by supporting the transition of enriched uranium capabilities into existing facilities and UPF and deactivating out-of-service systems in Building 9212. Activities include the following:
  - Complete installation, complete pre-operational testing, and achieve beneficial occupancy for the calciner in Building 9212 to process low equity uranium solutions and an electrorefining capability in Building 9215 to purify uranium metal.
  - Conclude pre-operational testing and transition the direct chip melt front loading furnace to production in Building 9215 and advance the direct chip melt bottom loading furnace project through the DOE O 413.3B process.
  - Reestablish a uranium oxide to metal conversion capability.

- Maintain working inventory levels of material to reduce safety and security risks in enduring facilities and optimize the material composition of the uranium inventory.
- Continue to implement a strategy to optimize limited space in enriched uranium facilities.
- Develop, sustain, and increase the reliability of uranium analytical and manufacturing capabilities to reduce risks.
- Extend the operational life of enduring enriched uranium facilities.
- Continue purified metal production.
- Reduce material inventory, deactivate systems and process and disposition of legacy materials to phase out mission dependency on Building 9212.
- Improve highly enriched uranium (HEU) feedstock quality before and during transition to the new and enduring facilities.

FY 2024 – FY 2027 Key Milestones

- Deactivate the wet chemistry process in Building 9212, reducing operational and safety risk in the facility.
- Initiate work to fabricate and install direct chip melt bottom-loading furnaces in Building 9215 to expand capacity of process chips.
- Advance the direct electrolytic reduction technology, which, with the electrorefining process, will provide the capability to convert uranium oxide to purified metal.
- Qualify the viability of casting enriched uranium parts using microwave technology, which is efficient and will improve the quality of the enriched uranium metal supply.
- Maintain Target Working Inventory, the minimum amount needed, within enduring facilities to enhance the safety of existing facilities that will be operational through the 2040s.
- Bridge the gap and reduce risk on an oxide conversion capability.
- Optimize quantity and quality of purified metal production.
- Update Highly Enriched Materials Facility capabilities to accommodate needs of the Uranium Processing Facility.

FY 2021 Accomplishments

- Produced five buttons with Production Operators utilizing the ER Development Glovebox system.
- Contracted for commercial solution to the uranium oxide to metal conversion capability gap.
- Established parameters for casting using microwave technology.
- Reduced risk by moving a quantity of material from production areas and into storage.
- Removed 10 pieces of out-of-service equipment in the enriched uranium production area to improve the flexibility and resiliency of operations.
- Deactivated 26 out-of-service systems to prepare for transitioning operations out of facilities, including Building 9212.

Uranium Modernization

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Uranium Modernization $306,689,000	**Uranium Modernization $297,531,000**	**Uranium Modernization -$9,158,000**
• Continued activities that will allow NNSA to phase out mission dependency on Building 9212 by supporting the transition of enriched uranium capabilities into existing and new-build facilities and deactivating out-of-service systems in Building 9212. • Produced five buttons with Production Operators utilizing the ER Development Glovebox system. • Contracted for commercial solution to the uranium oxide to metal conversion capability gap. • Produced purified enriched uranium feedstock to meet mission requirements. • Established parameters for casting using microwave technology. • Removed additional material from production areas and into storage. • Deactivated additional systems to prepare for transitioning operations out of facilities, including Building 9212.	• Continue activities that will allow NNSA to phase out mission dependency on Building 9212 by supporting the transition of enriched uranium capabilities into existing and new-build facilities and deactivating out-of-service systems in Building 9212. • Complete installation, pre-operational testing, and achieve beneficial occupancy for the calciner in Building 9212 to process low equity uranium solutions and an electrorefining capability in Building 9215 to purify uranium metal. • Continue development and execution of direct chip melt bottom-loading furnace to process machine turnings. • Continue efforts to reestablish a uranium oxide to metal conversion capability and optimize metal supply. • Continue material optimization efforts to reduce safety and security risks; achieve and maintain target working inventory levels and optimize the material composition of the uranium inventory. • Improve existing manufacturing capabilities and optimize floor space for flexible production capacity in enriched uranium facilities. • Extend the operational life of enduring enriched uranium facilities. • Continue purified metal production. • Deactivate systems and processing and disposition legacy materials to phase out mission dependency on Building 9212.	• Decrease reflects transition from procurement and installation towards startup and commissioning activities for Electrorefining and Calciner projects.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
	• Improve HEU feedstock quality before and during transition to the new and enduring facilities.	
06-D-141 Uranium Processing Facility, Y-12 $750,000,000	***06-D-141 Uranium Processing Facility, Y-12 $362,000,000***	***06-D-141 Uranium Processing Facility, Y-12 -$388,000,000***
• Continued construction of the Mechanical Electrical Building. • Continued construction of the Process Support Facility. • Continued construction and installation of process equipment for the Main Process Building and Salvage and Accountability Building • Began Readiness/Start Up Activities for the Mechanical Electrical Building.	• Execute contracts for the specialized equipment and bulk commodities needed for ongoing nuclear facility construction, leases, and for incremental commitments to previously awarded contracts to support progress on UPF. • Complete construction for the Main Process Building and Salvage and Accountability Building. • Begin startup testing and commissioning activities on the Main Process Building and Salvage and Accountability Building.	• Decrease reflects transition from peak construction activities towards startup and commissioning activities.

Secondary Capability Modernization
Depleted Uranium Modernization

Description

The Depleted Uranium (DU) Modernization Program enables the restart of lapsed capabilities to ensure NNSA can meet imminent weapons delivery mission requirements. These capabilities lapsed in the early 2000s due to the reuse of materials, low demand signals, and prioritization of other activities. These capabilities include feedstock procurement, restarting and maintaining DU and DU-niobium alloying and manufacturing capabilities, and investing in key new technologies. The capability to produce, process, and handle depleted uranium supports several key missions within the nuclear security enterprise, from providing components for LEPs to the down-blending of HEU to low-enriched uranium.

DU modernization supports re-establishing a reliable supply of High Purity DU (HPDU) metal. The current supply runs out in FY 2030. The program also supports restarting and maintaining existing DU operations and DU-niobium alloying capabilities to meet current and future weapon component needs. The DU-niobium alloy is also referred to as binary. To produce new binary, Y-12 will need to restart the Vacuum Induction Melt (VIM) - Vacuum Arc Remelt (VAR) - VAR production process (aka, VIM- VAR- VAR) to produce binary ingots. The program will also modernize the wrought manufacturing and machining capabilities needed for component manufacturing. Lastly, DU modernization will train operators, develop procedures, and assist with process qualification activities at LANL and LLNL.

The program is also investing in key new technologies to modernize production and meet future demands. Direct Casting would improve the existing component manufacturing process by significantly reducing the risks of current equipment failure, reducing material waste, and improving process efficiency. The program is also pursuing other technologies to provide additional opportunities for material reuse and recycling to reduce mission risk, such as Electron Beam Cold Hearth Melting (CHM). These new technologies could improve both the DU-niobium alloying process as well as the production of DU and binary components.

Depleted Uranium Modernization activities include the following:

1. Supply new High Purity DU (HPDU) metal feedstock by establishing a Depleted Uranium Tetrafluoride (DUF4) conversion capability.
2. Restart and maintain the VIM-VAR-VAR and component manufacturing processes at Y-12.
3. Develop, mature, and deploy key new technologies for insertion into production.
4. Track and execute risk mitigation strategies for DU feedstock supplies while setting up conversion capabilities.
5. Execute a bridging strategy to meet weapons deliverables through 2035 and increase component capacity with a mixture of modernized existing capabilities and new technologies.
6. Planning for the future Depleted Uranium Manufacturing Complex (DUMC).

Highlights of the FY 2023 Budget Request

- Execute strategy to re-establish a reliable supply of HPDU metal feedstock to meet mission requirements.
- Install newly procured equipment as part of the DU bridging strategy to mitigate risks associated with the aging material and component processes at Y-12.
- Startup critical VIM-VAR-VAR and wrought capabilities to support current and future weapon systems.
- Execute DU foundry modernization projects supporting binary production (e.g., 2nd VAR, Nitric Acid Tank, Swager).
- Develop technology for future insertion into production to reduce reliance on aging material and component processes, reduce material demands, and improve binary production efficiency. Technologies include Direct Cast and Cold Hearth Melting.
- Invest in DU storage capabilities and material modeling to ensure long-term availability of strategic materials.

FY 2024 – FY 2027 Key Milestones

- Re-establish a reliable supply of HPDU metal feedstock to meet mission requirements by FY 2028.
- Execute DU bridging strategy to meet critical near-term mission requirements.
- Produce a qualified binary ingot by restarting lapsed manufacturing processes by FY 2024.
- Achieve Technical Readiness Level 7 (Full-scale, similar system demonstrated in relevant environment) for Cold Hearth Melting by FY 2024.

- Implement investments as part of the DU bridging strategy to meet mission requirements through 2035.
- Increase storage capacities to provide a steady supply stream of material during peak production periods.

FY 2021 Accomplishments

- Conducted relevant analyses in support of the physics and engineering qualification for Direct Cast components, which is an important step in implementing the Bridging Strategy.
- Published a joint LLNL and LANL Binary Ingot Qualification Plan in support of VIM-VAR-VAR restart activities at Y-12, allowing the labs to have one specification for all weapon systems.
- Restarted LANL's development of the VAR furnace to enable the manufacture of development binary ingots, alleviating the risk of binary production and usage at Y-12.
- Completed engineering assessments of direct cast binary.
- Commissioned the CHM for future binary recycling and alloying.
- Production weld box (support equipment for VAR) was made operational.
- Initiated welding activities for 1st production VAR melts.
- Provided five binary ingots to Stockpile Programs with a prototype VAR.
- Completed installation and site acceptance testing of Direct Cast furnace to support advancement of technology and manufacturing readiness levels.

Depleted Uranium Modernization

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Depleted Uranium Modernization $110,915,000	**Depleted Uranium Modernization $170,171,000**	**Depleted Uranium Modernization +$59,256,000**
• Re-established a reliable supply of HPDU metal feedstock to meet mission requirements. • Restarted lapsed alloying and manufacturing capabilities to support future weapon systems. • Supported technologies for alloy and component production to reduce waste and costs. • Invested in DU storage capabilities and material modeling to ensure long-term availability of strategic materials.	• Down select a path forward to establish a reliable supply of HPDU metal feedstock to meet mission requirements. • Produce binary-ingots and test hardware and components with the newly restarted VIM-VAR-VAR and wrought capabilities to support current and future weapon systems. • Develop and deploy new technologies further, such as Direct Cast and Cold Hearth Melting, to improve alloying and component production efficiencies. • Establish more DU storage capabilities and conduct material modeling with new technology assumptions to ensure long-term availability of strategic materials. • Install newly procured equipment as part of the DU bridging strategy to mitigate risks associated with the aging material and component processes at Y-12.	• Increase is to invest in critical foundry modernization projects and activities to support Binary ingot production. • Increase will support the execution of scope to modernize the historical wrought process to meet component manufacturing demand and mitigate reliability risks. • Increase will support the DU Bridging Strategy by investing in activities and equipment needed to increase reliability and capacity for the existing wrought process (i.e., additional salt baths, annealing furnaces, lathes, direct cast furnaces, equipment controllers, etc.). • Increase will support the activities to mitigate against HPDU schedule risks associated with the DUF4 conversion project. • Increase is to perform operations supporting the development of the Cold Hearth Melter for binary recycling and alloying.

Secondary Capability Modernization
Lithium Modernization

Description

The Lithium Modernization program maintains the production of the nation's enriched lithium supply in support of Defense Programs, the DOE Office of Science, the Department of Homeland Security, and other customers. In addition, the program manages technology development that will improve the efficiency and reliability of the existing lithium capability and the Lithium Processing Facility (LPF).

Lithium materials for the nuclear weapons stockpile and other customers are currently processed in Y-12's Building 9204-2, a Manhattan Project-era building that has housed lithium processing since the 1950s. The historical processes are very corrosive in nature and have caused accelerated degradation to the facility. Additionally, the facility and its processes are oversized for today's mission, do not meet current codes/standards, and are well beyond their designed operational life.

The Lithium Modernization program supports operations for processing lithium materials to meet mission requirements. The program also plans and executes recapitalization projects and risk reduction activities to ensure that the current lithium processing capability is sustained until the LPF is operational in the 2030s. Additionally, the program is developing the operational release plan for startup and transition to full operations in LPF.

The program also supports the maturation of technologies and the development of process improvements that make lithium processing more efficient, safer to workers, and less impactful to surrounding infrastructure. In FY 2023, the Lithium Modernization program will begin an effort to increase lithium processing development and expertise to build future Lithium material SMEs across the enterprise, with key partnerships at LANL, LLNL, and PNNL.

Lithium Modernization activities include the following:

- Produce and maintain the lithium material inventory to meet current mission requirements and customer deliverables.
- Purify and convert lithium materials to lithium hydride and/or lithium deuteride (LiH/LiD), which are the two types of lithium materials used for component production.
- Recapitalize process equipment and perform risk reduction activities to sustain process capabilities until LPF comes online.
- Develop, mature, and deploy lithium purification and production technologies in support of the LPF baseline and beyond.

Highlights of the FY 2023 Budget Request

- Produce and maintain the lithium material supply to meet Defense Program (DP) mission and customer deliverables, including the maintenance of a configuration-controlled lithium supply and demand model.
- Continue to reestablish conversion and purification capabilities in support of near-term mission requirements.
- Maintain and recapitalize program equipment to reduce risk of single-point failures.
- Mature lithium technology alternatives for future deployment to improve processing efficiencies in support of the Lithium Strategy.

FY 2024 – FY 2027 Key Milestones

- Install an additional capacity Crusher Grinder equipment to eliminate a critical path single point of failure in the lithium material stream.
- Ramp up staffing to support the transition from Building 9204-2 to LPF.
- Begin lithium process transitions in support of a future operational release plan, ultimately transitioning lithium operations to the Lithium Processing Facility and reducing lithium mission reliance on Building 9204-2.

FY 2021 Accomplishments

- Completed all Lithium material deliverables on schedule to support component production.
- Updated and validated Lithium supply and demand model to inform future investments and ensure an adequate lithium supply.

- Completed restart of select lithium salvage operations to reclaim lithium from consumable materials prior to disposition.
- Migrated Lithium Integrated Master Schedule to classified system to better integrate and prioritize investments.
- Completed Lithium Crystallization and Material Conversion and Equipment Refurbishment (MCER) recapitalization projects required to supply lithium materials for near-term weapons deliverables.
- Updated Lithium Infrastructure Implementation Plan for recapitalization and risk reduction for the aging Building 9204-2.

Lithium Modernization

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Lithium Modernization $39,400,000	**Lithium Modernization $68,661,000**	**Lithium Modernization +$29,261,000**
• Continued Wet Chemistry and Material Conversion operations in support of requirements. • Continued to process LiH and LiD in support of deliverables. • Planned and began executing additional recapitalization of process equipment to sustain process capabilities. • Planned and executed activities to reduce risk to the facility and process equipment. • Planned rapid response processes for most likely operational failure modes. • Continued the maturation of technologies for near term use. • Continued to support LPF capital acquisition.	• Process LiH and LiD in support of deliverables. • Plan and begin execution of Lithium Lab Area Upgrades project in support of requirements. • Complete installation of additional evaporator (Bird Bath). • Begin design and execution of Backup Crusher/Grinder project. • Plan and prioritize activities in the Lithium Process Equipment Relocation risk reduction activity. • Continue to plan and execute activities to reduce risk to the facility and process equipment. • Plan rapid response processes for most likely operational failure modes. • Continue the maturation of technologies for near term use.	• Increase to fully fund minor construction projects including Lithium Lab Area Upgrades, Backup Crusher/Grinder project and the Lithium Process Equipment Relocation risk reduction activity.
18-D-690 Lithium Processing Facility, Y-12 $109,405,000	***18-D-690 Lithium Processing Facility, Y-12 $216,886,000***	***18-D-690 Lithium Processing Facility, Y-12 +$107,481,000***
• This was under Infrastructure and Operations.	• Achieve CD-3A to authorize long lead procurements and site prep. • Continue process design work. • Continue facility design work. • Execute long lead procurement fabrication contracts such as Crusher Grinder, Isostatic Press, and Machining Mill and Lathe complexes. • Execute site preparation contract. • Begin testing to achieve TRL 7 for homogenization (HMG) technology, a new technology for LPF that will improve material health.	• Increase due to ramp up staffing, procurements, design work, and other on scope priorities as the project continues to work towards CD-2/3 to establish project baseline and begin construction.

Production Modernization
Tritium and Domestic Uranium Enrichment

Overview

The Tritium Modernization and Domestic Uranium Enrichment (DUE) program is responsible for producing tritium and supplying unobligated low-enriched uranium to support national security needs. The program includes (1) Tritium Modernization and (2) Domestic Uranium Enrichment.

The Tritium Modernization program operates the national capability for producing, recovering, and recycling tritium. The Tritium supply chain's capacity is increasing as part of a multi-year plan to reliably meet national security requirements. DOE/NNSA produces new tritium by irradiating Tritium Producing Burnable Absorber Rods (TPBARs) in two of the Tennessee Valley Authority's (TVA's) light water reactors (Watts Bar 1 and 2) The TPBARs are inserted into fuel assemblies that contain low enriched uranium. Once irradiated for 18-months, the TPBARs are removed and then shipped to the Savannah River Site's (SRS's) Tritium Extraction Facility (TEF) where the tritium is extracted and loaded into gas bottles. SRS also recovers tritium from returned reservoirs. The recovered tritium is processed, added to existing tritium inventories, and made available for future use.

The DUE program is responsible for ensuring a reliable supply of enriched uranium to support national security. The DUE program provides unobligated, low-enriched uranium (LEU) for tritium production by managing existing uranium stocks and downblending HEU declared excess to national security needs. LEU inventories identified by the DUE program will sustain tritium production through 2044, at which point the United States will require a new domestic uranium enrichment capability to meet tritium production and other national security needs. The DUE program preserves and advances uranium enrichment technology for potential future deployment to meet national security needs.

Tritium and Domestic Uranium Enrichment
Tritium Sustainment and Modernization

Description

The Tritium Sustainment and Modernization program operates the national capability for producing tritium. The Tritium supply chain's capacity is increasing as part of a multi-year plan to reliably meet national security requirements. Since FY 2003, NNSA has been producing tritium by irradiating TPBARs in the Watts Bar Nuclear Plant Unit 1 (nuclear power reactor) operated by TVA, during normal 18-month operating cycles. The tritium inventory is required to meet national security requirements including support for limited-life component exchanges of tritium reservoirs that are deployed in the stockpile. The program establishes tritium production schedules, based on detailed computational models and annual tritium reconciliations, to maintain required tritium inventories, including reserve quantities. Production planning takes into consideration the material that is constantly being recovered and recycled from deployed reservoirs, including those from weapon dismantlements.

FY 2023 funding for the Tritium Finishing Facility (TFF) at the Savannah River Site will continue support for process building preliminary design activities. The TFF project relocates critical capabilities currently housed in the 60-year-old H-Area Old Manufacturing (HAOM) facility. The infrastructure of this building has deteriorated and is well beyond expected end-of-life. These critical capabilities, housed in deteriorating facilities, create a substantial risk to the enduring Tritium Mission. Infrastructure failures, mainly electrical systems, have increased the frequency of production delays and led to increased safety, security, maintenance, and operating costs. The new facilities within the TFF project will adhere to the new and more stringent DOE/NNSA construction standards. TFF infrastructure is based on analyses of accidents/impacts of natural phenomena, such as earthquakes and high wind events.

Highlights of the FY 2023 Budget Request

- Execute additional component procurements and TPBAR assemblies to satisfy increased production requirements.
- Commence irradiation of 1,792 TPBARs in WBN1 Cycle 18, complete irradiation of 544 TPBARs in WBN2 Cycle 04, and commence irradiation of a minimum of 1104 TPBARs in WBN2 Cycle 05.
- Proceed with implementation of tritium production assurance, including advanced mitigation planning for extended reactor outages.
- Conduct six extractions at the Tritium Extraction Facility (TEF), beginning the ramp-up to full operations mode.
- Maintain a purified tritium supply and enable delivery of tritium for national security needs.
- Disposition of helium-3 byproduct for U. S. government needs.
- Execute process system sustainment plan (PSSP) to refurbish or replace tritium processing equipment.
- Execute research and development (R&D) activities supporting extraction, recycle and recovery, risk mitigation activities, and technology maturation efforts.
- Provide OPC funding for the TFF line-item project.
- Complete preliminary design as currently scheduled.
- Work to complete activities in FY 2023 to support obtaining CD-2/3 earlier in FY 2024 for the Site Prep and Warehouse subproject.

FY 2024 – FY 2027 Key Milestones

- Provide a cost-effective tritium supply chain that meets the inventory requirements.
- Fabricate and deliver ~14K TPBARs to TVA.
- TVA irradiate ~16K TPBARs in both WBN1 and WBN2.
- Complete ~46 shipments of irradiated TPBARs to the TEF (~14K TPBARs).
- Complete ~36 extractions at TEF (~11K TPBARs).
- Invest in measures to increase confidence in the tritium supply chain.
- Recycle, recover, and purify tritium and helium-3 byproduct.
- Support Weapons Engineering Tritium Facility (WETF) de-inventory mission at LANL.
- Provide a cost-effective tritium supply chain that meets the inventory requirements.
- Increase production to 2,800 grams of tritium over an 18-month reactor cycle by 2024.
- Further ramp up production levels, reliably producing 3,300 grams by 2025.
- Increase the number of yearly extractions at the TEF to eight by 2026.

- Maintain a purified tritium supply and enable delivery of tritium for national security needs.
- Disposition helium-3 byproduct for U.S. government needs.
- Execute process system sustainment plan (PSSP) to refurbish or replace tritium processing equipment.
- Initiate a CD-3A long-lead procurement of a mass spectrometer in FY 2024.
- Work toward CD-2 and CD-3 completion in early FY 2025.
- Begin construction in FY 2025.

FY 2021 Accomplishments

- Continued irradiation of 1,792 TPBARs in Cycle 17 in WBN1 reactor and 544 TPBARs in Cycle 4.
- Completed five extractions of 300 TPBARs at the TEF, procured one waste cask and dispositioned four extracted consolidation containers.
- Completed five shipments of TPBARs to TEF and one waste shipment from TVA to NNSS.
- Completed analytical chemistry for pellet lots to support all Cycle 18 and Cycle 5 core design options.
- Issued TPBAR Design Evolution Strategy Report.
- Received approval of FSLOCA LAR and prepared for implementation following refueling outages.
- Completed Dry Cask Test for >30 KW Loading and loaded 5 casks with greater heat load.
- Led Tritium Science Program studies at multiple DOE labs.
- Recovered and recycled tritium to meet NNSA requirements and managed helium-3 byproduct to not impact Gas Transfer System mission.
- Completed replacement of four HT-TCAP hydride beds.
- Completed CD-2/3 Task Analysis and Schedule.
- Completed Site Prep-Startup Testing Implementation Plan.
- Completed Safeguards and Security Requirements Identification Document.
- Awarded Fluor Affiliate Task Order 1.
- Completed Enercon Site Prep Design.
- Prepared an approved design performance baseline change proposal to develop a cost and schedule plan for the TFF.

Tritium Sustainment and Modernization

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Tritium Sustainment and Modernization $312,109,000	**Tritium Sustainment and Modernization $361,797,000**	**Tritium Sustainment and Modernization +$49,688,000**
• Addressed technical issues for increasing TPBAR production and NRC licensing actions. Support WBN core design and core performance analysis. • Received NRC approval for the LAR to implement BELOCA evaluation methodology for Watts Bar Units 1 and 2 tritium production. • Started fabrication of 1,792 TPBARs for WBN1 Cycle 18 and a minimum of 864 TPBARs for WBN2 Cycle 05. • Continued Cycle 17 irradiation of 1,792 TPBARs and loaded 544 TPBARs at WBN2 for Cycle 04. • Conducted five TPBAR shipments to the TEF • Continued design of TPBAR transportation cask and finalize performance work statement for transportation services. • Conducted five extractions at the TEF and procure additional waste casks. • Conducted post-irradiation examination of pellet test samples from INL's ATR; conduct tritium experiments, analysis, and modeling to reduce production risks; and monitor industry developments of future technologies. • Recovered, recycled, and purified tritium and disposition helium-3 byproduct. • Executed process system sustainment plan activities. • Executed R&D activities to reduce and mitigate risk to extraction and recycle and recovery activities.	• Execute additional component procurements and TPBAR assemblies to satisfy increased production requirements. • Complete irradiation of 1,792 TPBARs in WBN1 Cycle 18, and 1104 TPBARs in WBN2 Cycle 05. • Complete fabrication of 1,792 TPBARs for WBN1 Cycle 19 and 1300 TPBARs for WBN2 Cycle 06. • Proceed with implementation of tritium production assurance, including advanced mitigation planning for extended reactor outages. • Commence WBN1 Cycle 19 TPBAR Irradiation. • High-capacity TPBAR transport cask delivery. • Conduct nine TPBAR shipments to the TEF. Ship low-level hardware waste to NNSS. • Conduct six extractions at the Tritium Extraction Facility (TEF), beginning the ramp-up to full operations mode. • Maintain a purified tritium supply and enable delivery of tritium for national security needs. • Disposition helium-3 byproduct for U.S. government needs. • Execute process system sustainment plan (PSSP) to refurbish or replace tritium processing equipment. • Execute research and development (R&D) activities supporting extraction, recycle and recovery, risk mitigation activities, and technology maturation efforts. • Provide OPC funding for the Tritium Finishing Facility line-item project.	• Increased production requirements that necessitate additional TPBAR assemblies and irradiation costs. • Increased funding will allow additional licensing of TVA reactors beyond 1,792 TPBARs to allow NNSA flexibility in meeting future tritium production requirements. • Increased funding will allow a Spent Fuel Pool Rerack: A high-density rerack would ease the fuel selection issues for dry cask loads and provide schedule flexibility, should a cask-loading campaign need to be cut short or a full-core offload is necessary. • Increased funding for a Hot and Cold Nitrogen Replacement: Funding to procure long lead items to support TCAP column A and Hot and Cold nitrogen outage.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
18-D-650 Tritium Finishing Facility, SRNS ***$27,000,000***	***18-D-650 Tritium Finishing Facility, SRNS*** ***$73,300,000***	***18-D-650 Tritium Finishing Facility, SRNS*** ***+$46,300,000***
• Hired an architect-engineer subcontractor to advance the design from 5% complete towards 30% complete.	• Complete Preliminary Design as currently scheduled but ramp up Final Design, allowing Final Design to complete 3-6 months earlier. • Work to complete activities in FY 2023 to support obtaining CD-2/3 earlier in FY 2023 for the Site Prep and Warehouse subproject.	• Increased funding to complete Final Design 3-6 months earlier than initially planned. • Increased funding to complete activities in FY 2023 to support obtaining CD-2/3 earlier in FY 2023 for the Site Prep and Warehouse subproject.

Tritium and Domestic Uranium Enrichment
Domestic Uranium Enrichment

Description

The Domestic Uranium Enrichment program is responsible for ensuring a reliable supply of enriched uranium to support U.S. national security needs. Since the closure of the Paducah Gaseous Diffusion Plant in 2013, the United States has lacked the capability to produce enriched uranium free of peaceful use obligations (i.e., unobligated). DOE/NNSA requires unobligated enriched uranium to fuel reactors that produce tritium for nuclear weapons and to power the nuclear Navy. The DUE program is implementing a three-pronged strategy to supply current enriched uranium needs and re-establish a supply of enriched uranium to meet long-term needs. First, NNSA seeks to ensure and extend availability of its unobligated LEU fuel supply through 2044 by down-blending excess HEU. Second, DUE is preserving and advancing uranium enrichment expertise and technology to meet current and future U.S. government needs. Third, DUE is executing the acquisition process to re-establish a long-term supply of enriched uranium to support future U.S. national security needs.

Domestic Uranium Enrichment activities include the following:

1. Manage Departmental uranium inventories to support tritium production, including down-blending of excess HEU.
2. Preserve and advance uranium enrichment expertise and technology.
3. Execute the acquisition process to deploy a domestic uranium enrichment capability.

Highlights of the FY 2023 Budget Request

- Continue down-blending of HEU from existing uranium inventory to provide LEU fuel for tritium production.
- Continue to seek and secure additional sources of unobligated enriched uranium to support the tritium production mission.
- Preserve and advance uranium enrichment expertise and technology for current and future U.S. national security needs through the Domestic Uranium Enrichment Centrifuge Experiment (DUECE) centrifuge technology research and development.
- Continue the acquisition process towards *Approval of Alternative Selection and Cost Range* (CD-1) for a domestic uranium enrichment capability.

FY 2024 – FY 2027 Key Milestones

- Complete down-blending campaign in FY 2025 to provide additional LEU fuel for tritium production.
- Perform final down-select for a domestic uranium enrichment technology in the mid-2020s.

FY 2021 Accomplishments

- Continued down-blending campaign, which successfully delivered unobligated LEU on schedule.
- Secured additional unobligated LEU held at the Portsmouth, OH cleanup site, which provided an additional 1.5 reloads and, when combined with the ongoing down-blending campaign, extended the need date for LEU fuel for tritium production to 2044.
- Successfully tested DUECE small centrifuge design at Oak Ridge National Laboratory in a demonstration cascade on uranium gas.
- Continued the acquisition process towards Approval of Alternative Selection and Cost Range CD-1 for a domestic uranium enrichment capability.

Domestic Uranium Enrichment

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Domestic Uranium Enrichment $160,000,000	**Domestic Uranium Enrichment $144,852,000**	**Domestic Uranium Enrichment -$15,148,000**
• Continued down-blending campaign to extend the need date for LEU fuel for tritium production to 2044. • Worked to identify additional sources of unobligated enriched uranium to support the tritium production mission. • Continued to preserve and advance uranium enrichment expertise and technology to meet current and future U.S. national security needs. • Continued the acquisition process for a domestic uranium enrichment capability. • Continued HEU Downblend campaign to extend the need date for LEU fuel for tritium production.	• Continue down-blending campaign to extend the need date for LEU fuel for tritium production. • Continue to seek and secure additional sources of unobligated enriched uranium to support the tritium production mission. • Continue to preserve and advance uranium enrichment expertise and technology to meet current and future U.S. government needs. • Continue the acquisition process for a domestic uranium enrichment capability. • Begin design activities for an enrichment technology pilot plant, if appropriate. • Complete DUECE Demonstration Cascade 2 Minor Construction project at ORNL. • HEU Downblend funding requested under the Domestic Uranium Enrichment funding line in FY 2023.	• Decrease reflects program plan to spend down prior year carryover. • Funding for HEU down-blending, which had previously been appropriated in a separate HEU Downblend line, is now included in the Domestic Uranium Enrichment line. • Increased scope of centrifuge development as the program advances towards larger-scale demonstration. Specifically, this includes increases in R&D personnel and long-lead procurements for the DUECE Demonstration Cascade 2 experiment.

Tritium and Domestic Uranium Enrichment
Uranium Reserve

Description

The Department of Energy, Office of Nuclear Energy (DOE/NE), in coordination with NNSA, worked to develop and implement the Uranium Reserve program in FY 2021. DOE/NE and NNSA are planning to establish a uranium reserve by procuring uranium and conversion services for that uranium, storing the domestically produced natural uranium hexafluoride (UF_6) at commercial facilities in the United States, and developing governance processes and criteria for the material's end use. No funds are requested for this program in FY 2023.

Highlights of the FY 2023 Budget Request

- No funds from NNSA are requested for this program in FY 2023.

FY 2021 Accomplishments

- A Request for Information (RFI) was released in FY2021 to inform the procurement strategy for the Uranium Reserve.

Uranium Reserve

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Uranium Reserve $75,000,000	**Uranium Reserve $0**	**Uranium Reserve -$75,000,000**
• As directed by Congress, NNSA is working with the DOE Office of Nuclear Energy to develop a plan for the Uranium Reserve.	• No funding requested for FY 2023.	• Decrease in funding for the Uranium Reserve which is not requested for FY 2023.

Production Modernization
Non-Nuclear Capability Modernization

Description

The Non-Nuclear Capability Modernization program manages projects and executes strategies to modernize, monitor, and ensure enduring availability of non-nuclear capabilities and capacities for multiple weapon systems. Non-nuclear components are a significant portion of the costs for the weapons systems due to the number of parts, complexity, and testing of the warhead. This program provides management and oversight of strategic investments to modernize capabilities for design, qualification, production, and sustainment of non-nuclear components for multiple weapon systems. NNCM provides increased capability and capacity, as well as development of strategies, processes and new capabilities, and programmatic equipment for production of non-nuclear components.

Non-Nuclear Capability Modernization activities include the following:

1. Procure equipment to meet non-nuclear component manufacturing capacity requirements.
2. Increase in capacity and capability of non-nuclear component manufacturing within the nuclear security enterprise and extend and strengthen the trusted supplier base.
3. Sustain NNSA's capability to produce trusted microelectronics.
4. Recapitalize critical capabilities for the design, production, and qualification of nuclear weapon electrical and mechanical systems.
5. Modernize capabilities with a fragile vendor base such as those supporting Power Sources program deliverables.
6. Reduce component manufacturing costs through introduction of modernized processes and technologies.
7. Develop and implement a front-end assurance system model for commercial-off-the-shelf (COTS) parts to reduce risk in weapons modernization programs.
8. Address specific weaknesses in NNSA's industrial base and supply chain risks due to commercial technology trends and domestic market conditions through a strategic approach to implementing mitigation activities that address multiple-program and cross-site risks.
9. Identify and monitor materials used in nuclear weapons that are at risk of obsolescence, discontinuation, scarceness, unavailability, or usability issues.
10. Modernize production of non-nuclear components through long range planning and OPC activities for line items.

Highlights of the FY 2023 Budget Request

- Expand KCNSC manufacturing capacity to meet program of record (PoR) production requirements.
- Procure tools and equipment for the development, production, testing, qualification, and sustainment of power sources.
- Procure fabrication tools and equipment to enable continued manufacturing of trusted strategic radiation hardened (TSRH) microsystems at the MESA complex for the nuclear weapon stockpile.
- Refurbish SNL's SATURN X-Ray effects testing capabilities, which are critical to ensuring that non-nuclear components can survive the complex and extreme environments of the Stockpile to Target Sequence.
- Refurbish SNL's ACRR radiation testing facility, which is critical for qualification and surveillance testing of all weapons systems.
- Develop and implement a front-end assurance system model for COTS parts to reduce risk in weapons modernization programs.
- Procure production tools and equipment to enable manufacturing of Neutron Generators for the nuclear weapons stockpile.
- Develop thermal spray production capability needed to meet requirements of modernization systems.
- Continue strategic sourcing risk mitigation project to prioritize and implement low-cost high-payoff mitigation actions to target distressed commodities and vendors and implement commodity strategies that reduce overall supply chain risks.
- Continue implementation of an enterprise-wide effort for early identification of at-risk-materials and development of solutions to avoid mission supply chain interruptions.
- Begin funding responsibility for programmatic equipment acquisition and maintenance (previously funded in Infrastructure and Operations) for Accelerator (including facilities such as SATURN and HERMES) and Major Environmental Test Facilities (METF) at SNL.

- Obtain CD-0 for the Microelectronics Heterogeneous Integration Facility (HIFac) line-item project.

FY 2024 – FY 2027 Key Milestones

- Complete KCNSC short-term expansion plan, FY 2026.
- Obtain CD-1 (Approve Alternative Selection and Cost Range) for Power Sources Capability, FY 2024.

FY 2021 Accomplishments

- Expanded KCNSC manufacturing capacity to meet PoR production requirements through 2026.
- Procured fabrication tools and equipment to enable continued manufacturing of trusted strategic radiation hardened (TSRH) microsystems at the MESA complex for the nuclear weapon stockpile.
- Began refurbishment of SNL's SATURN X-Ray effects testing capabilities, which are critical to ensuring that non-nuclear components can survive the complex and extreme environments of the Stockpile to Target Sequence.
- Developed and implemented a front-end assurance system model for COTS parts to reduce risk in weapons modernization programs.
- Initiated development of thermal spray production capability needed for future systems.
- Supported establishing a university-led Center of Excellence to focus on developing new additive and advanced manufacturing techniques, technologies, and methodologies to evaluate, diagnose, and control materials for production and manufacturing purposes.

Non-Nuclear Capability Modernization

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Non-Nuclear Capability Modernization $107,137,000	***Non-Nuclear Capability Modernization $123,084,000***	***Non-Nuclear Capability Modernization +$15,947,000***
• Modernized environmental testing, power source production, and trusted radiation-hardened microelectronics capabilities at SNL. • Studied process improvements to reduce manufacturing costs across the enterprise. • Expanded manufacturing capability at KCNSC to address increased capacity needs due to increased LEP requirements. • Developed and began implementation of a front-end assurance system model for COTS parts to reduce risk in weapons modernization programs. • Initiated development of thermal spray production capability for modernization programs.	• Continue expanding manufacturing capability at KCNSC to address increased capacity needs for PoR requirements through 2026. • Continue OPC funding for the Power Source Capability (PSC) and Heterogeneous Integration Facility line-item projects. • Continue development of thermal spray production capability for modernization programs. • Continue to modernize environmental testing, power source development, and trusted radiation-hardened microelectronics capabilities at SNL. • Continue implementation of a front-end assurance system model for COTS parts to reduce risk in weapons modernization programs. • Support for modernization efforts for radiation testing facility at SNL (ACRR). • Continue implementation of the Tester Transformation Initiative to establish a means for pre-qualifying testers to a common DA/PA platform. • Procure production tools and equipment to enable continued manufacturing of Neutron Generators for the nuclear weapons stockpile. • Replace Power Sources programmatic equipment beyond service life for use in Agile Facility and PSC.	• Increase will fund the inclusion of Accelerator and METF programmatic equipment maintenance and procurement requirements at SNL. • Increase for support for modernization efforts for radiation testing facility (ACRR) at SNL. • Increase to improve tester requirements and ensure that designs and hardware meet requirements for the Tester Transformation Initiative at SNL. • Increase for the Development of industrial base and supply chain strategic approach to implement mitigation activities that address multiple-program and cross-site risks.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
	• Continue studies of process improvements to reduce manufacturing costs across the enterprise.	

Production Modernization
Capability Based Investments

Description

The Capability Based Investments (CBI) program executes projects to replace or enhance core enterprise capabilities through recapitalization of high risk of failure test, measurement, and production equipment. CBI addresses enduring, multi-program requirements through discrete, short-duration projects. These investments recapitalize scientific and manufacturing capabilities that have degraded due to aging, broken, or outdated equipment and supporting systems. CBI activities primarily include capital equipment purchases and minor construction projects that enable installation and use of the equipment and associated capabilities. These investments address needs beyond any single facility, campaign, or weapon system and are essential to achieving DP mission objectives. The CBI portfolio reduces programmatic risk to mission across the nuclear security enterprise and ensures needed capabilities are available for stockpile stewardship, sustainment, and modernization.

Highlights of the FY 2023 Budget Request

- Table I shows the planned CBI projects to be executed with FY 2023 funding based on the status of enterprise infrastructure as of April 2022. This plan may need to be updated before the FY 2023 execution year to respond to changing infrastructure conditions and requirements.

Table I

National Nuclear Security Administration Capability Based Investments Planned FY 2023 Recapitalization Projects - As of April 2022		
Site	**Project Name**	**FY 2023 Allocation ($K)**
KCNSC	Development Laboratory Modernization	1,000
	Special Application Machining Modernization	1,200
	Gas Transfer Systems Production Modernization	2,500
	Analytic Lab Equipment	1,000
	Assembly and Electrical Fabrication Equipment	2,300
Subtotal, Kansas City National Security Campus		**8,000**
LLNL	Applied Material Engineering Consolidation	7,800
	LEP Equipment Capabilities Replacement Project	11,560
	Stockpile to Target Sequence Environmental Capabilities	5,490
	Detonation and Dynamic Diagnostic Deployment	1,911
	Site 300 Firing and Control System Modernization	2,239
	Flexible Production Capacity Initiative	1,000
Subtotal, Lawrence Livermore National Laboratory		**30,000**
LANL	Fabricate pRad Outer Vessel	3,000
	Forming and Fabrication Equipment Upgrades at Sigma (New Press)	5,400
	TRU Waste GloveBox Field Installation	6,200
	PF-4 Trolley Buss Bar Refurbishment	3,060
	DARHT Reliability Capability Upgrades, Phase II	2,340
	Flexible Production Capacity Initiative	1,000
Subtotal, Los Alamos National Laboratory		**21,000**
NNSS	Programmatic Mission Power Equipment	2,500
	U1a Diagnostics Control Connectivity	1,500
	Multi-Axis Lathe/Mill Replacement	2,500
	Calibration Laboratory Capacity Upgrade	2,500
	U1a Ventilation	2,500
	High Explosives Assembly Capability	2,500
	Flexible Production Capacity Initiative	1,000
Subtotal, Nevada National Security Site		**15,000**
PX	Mass Properties Measurement Machine - Bay 12 (Replacement)	3,000
	SNM Component Staging Facility (SNMCRF) (Replacement)	4,000
	Procure Three Lathes for Production Tooling	1,200
	Flexible Production Capacity Initiative	2,000
Subtotal, Pantex Plant		**10,200**
SNL	Major Environmental Test Facilities Refurbishments and Upgrades	8,250
	Primary Standards Lab (PSL) Equipment	990
	Accelerators Upgrades	1,320

National Nuclear Security Administration Capability Based Investments Planned FY 2023 Recapitalization Projects - As of April 2022		
Site	**Project Name**	**FY 2023 Allocation ($K)**
	Tonopah Test Range Equipment Refurbishment	500
	Electrical Sciences Equipment Recapitalization	4,120
	Reactor Equipment	1,320
	Neutron Diagnostic (ND) Programs Equipment Recapitalization	1,000
	Flexible Production Capacity Initiative	1,000
Subtotal, Sandia National Laboratories		**17,500**
SRS	Replace Inert Met Lab Scanning Electron Microscope	1,700
	Replace Film Radiography in Finishing Gloveboxes, FL 4&5	1,200
	Mass Spec Replacement Project #1B	3,000
	Flexible Production Capacity Initiative	1,000
Subtotal, Savannah River Site		**6,900**
Y12 National Security Campus	Dimensional Standards Lab HVAC (AHU-108)	2,500
	Gear Lab HVAC (AHU-109)	500
	Install Leitz Infinity CMM (1&2)	2,700
	Leitz Infinity CMM #2 (M32/48)	2,700
	225 kV Microfocus/450 kV CT	2,900
	225 kV Microfocus CT	2,900
	Additional 5 Axis Mill	4,000
Subtotal, Y-12 National Security Complex		**18,200**
	Flexible Production Capacity Initiative	3,000
	Corporate Reserves, Taxes and Assessments	4,627
	CBI Planning, Design, Program Management and Reserves	19,793
Grand Total, Capability Based Investments		**154,220**

FY 2024 – FY 2027 Key Milestones

- Meet current commitments that enable W80-4 and W87-1 modernization programs by FY 2025.
- Complete equipment replacement and refurb projects at LANL that support the roadmap to 30 pits per year.
- Modernize sub-critical testing capabilities used for stockpile assessment, NEP design, and weapon certification activities to support planned sub-crit schedules.

FY 2021 Accomplishments

- Replaced PF4 trolley control cabinets, LANL.
- Established metal additive manufacturing capability, Y12.
- Established Laser Powder Bed Fusion (LPBF) Capability, KCNSC.
- Supported new DA/PA integrated Polymer Enclave, LLNL.
- Re-constituted DARHT confinement vessel production capability, LANL.
- Completed design for new WETL High-G centrifuge, SNL.

Capability Based Investments

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Capability Based Investments $149,117,000	**Capability Based Investments $154,220,000**	**Capability Based Investments +$5,103,000**
• Program was under Infrastructure and Operations. • CBI provided targeted, strategic investments for life-extension and modernization of enduring requirements needed to sustain Defense Programs' capabilities.	• Table I contains the current FY 2023 project plan as of February 2022. CBI project funds are allocated in accordance with planned priorities but retain the flexibility to adjust efforts to address emerging changes in priorities and unplanned programmatic equipment failures.	• The increase provides for the expansion of the Flexible Production Capacity Initiative, which identifies and removes out-of-service equipment in active production areas to create usable space, adding flexibility and agility for new and existing mission.

Production Modernization
Planning for Programmatic Construction

Description

This program consolidated funding for planning activities necessary to approve mission need and approve alternative selection and cost range for a portfolio of mission needs and related project proposals at multiple NNSA sites: The Power Sources Capability (PSC), SNL; Combined Radiation Effects Survivability Testing (CREST), SNL; Energetic Materials Characterization Facility (EMCF), LANL; Heterogeneous Integration Facility (HIFac), SNL.

Highlights of the FY 2023 Budget Request

- NNSA is not requesting funding in the Planning for Programmatic Construction (pre-CD-1) line. These activities will be funded within the sponsoring programs.
- The shift to account for pre-CD-1 funds at the program level more directly allocates other project cost (OPC) funds to prioritized projects.
- This shift does not reflect an overall decrease of $10M, rather it moved accounting for the funds associated with the scope from the "Planning for Programmatic Construction" funding line to specific programs.

FY 2021 Accomplishments

Activities included the development of mission need and project requirements documents, cost estimates, analyses of alternatives, acquisition strategies, conceptual designs, and other important pre-CD-1 documentation.

Planning for Programmatic Construction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Planning for Programmatic Construction **$10,000,000**	**Planning for Programmatic Construction** **$0**	**Planning for Programmatic Construction** **-$10,000,000**
• Pre-CD1 activities to mature planning for CREST, EMCF, PSC, HIFAC and NNCC.	• No funds are requested at the planning for Programmatic Construction line. The shift to account for pre-CD-1 funds at the program level more directly allocates other project cost (OPC) funds to prioritized projects rather than at the Defense Programs level.	• This decrease reflects a shift in accounting for the funds associated with the scope from the "Planning for Programmatic Construction" line in specific programs.

Production Modernization
Capital Summary

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	301,336	494,716	460,447	+159,111
Minor Construction	N/A	N/A	67,172	79,096	135,155	+55,877
Total, Capital Operating Expenses	**N/A**	**N/A**	**368,508**	**573,812**	**595,602**	**+214,988**
Capital Equipment > $500K (including MIE)						
Total Non-MIE Capital Equipment (>$500K and <$5M)	N/A	N/A	131,917	134,819	137,785	+5,868
Expanded Flash X-Ray System, LLNL	5,556	2,967	2,589	0	0	-2,589
DAF Glovebox Exhaust System, LLNL	24,000	0	0	24,000	0	0
Next Generation Machining and Assembly for High Volume Pit Production, LLNL	8,915	0	0	8,915	0	0
DAF Pit Certification support gloveboxes, LLNL	7,100	0	0	0	0	0
DAF pit residue processing gloveboxes, LLNL	8,600	0	0	0	0	0
DAF End of Life equipment replacement, LLNL	13,500	0	0	0	0	0
Forming & Fabrication Equipment Upgrades at Sigma (New Press), LANL	8,300	0	0	8,300	0	0
TRU Waste Glovebox Field Installation, LANL	8,000	0	0	8,000	0	0
TRU Waste Glovebox Project, LANL	17,843	2,719	6,599	6,080	2,445	-4,154
Foundry Upgrades Parts Staging (Previously Foundry Upgrades Phase 3), LANL	26,533	2,390	2,238	6,048	15,857	+13,619
LANL	10,128	4,602	1,000	4,526	0	-1,000
Final Machining #2 (Previously T-Base #1 Replacement), LANL	32,938	1,870	2,833	24,732	3,503	+670
Subassembly Installation, LANL	10,554	0	0	3,340	0	0
Immersion Density, LANL	10,459	3,423	1,586	3,145	2,305	+719
Heat Treat (90%), LANL	16,742	0	1,568	15,174	0	-1,568
CNC Lathe (90%), LANL	13,361	2,780	1,759	2,408	6,414	+4,655
Machining Parts Staging #1 (Previously Machining (Parts Staging)), LANL	18,163	0	2,142	8,018	8,003	+5,861
Machining Parts Staging #2, LANL	20,694	0	1,735	6,832	0	-1,735
Foundry Immersion Density, LANL	8,907	1,476	1,394	1,274	0	-1,394
Coordinate Measurement Machine (CMM) #2, LANL	44,713	26,650	6,798	7,504	3,761	-3,037

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Equipment > $500K (including MIE)						
Turnings Consolidation glovebox (Previously Install new turnings consolidation glovebox), LANL	35,000	0	0	0	0	0
Microscopy Upgrades Project (MUP) (Previously Microprobe - TA-55), LANL	22,467	0	6,022	8,481	7,964	+1,942
Basement Radiography Upgrades, LANL	20,376	6,148	4,419	3,032	6,777	+2,358
Aqueous Nitrate Evaporator Upgrades (Prevously AQ-Nitrate Upgrades), LANL	12,336	0	0	0	0	0
Aqueous Nitrate Cement Fixation Upgrades, LANL	12,689	0	0	0	0	0
PPCW (Positive Pressure Chilled Water Upgrades) (Previously Chilled Water and Compressed Air), LANL	8,300	0	0	1,795	0	0
Process Compressed Air Upgrades (PCA), LANL	8,701	0	0	1,792	0	0
TIMS #3 into RLUOB, LANL	8,612	0	0	2,856	0	0
Room 126 MR&R Upgrade, LANL	22,873	9,763	8,388	4,722	0	-8,388
PF-4 nuclear material vault storage upgrade, LANL	6,500	1,000	3,000	2,500	0	-3,000
AQ-Nitrate Recovery Upgrades (Previously Oxide Roast Glovebox), LANL	10,486	1,600	0	8,886	0	0
Size Reduction Press GB Installation, LANL	18,895	0	0	7,600	0	0
Electrorefining Line MC&A GB, LANL	12,867	0	0	12,867	0	0
D&D Bostomatic, LANL	9,226	3,621	3,300	2,305	0	-3,300
Manufacturing Modernization Project (MMP), LANL	32,768	16,626	4,836	4,633	6,673	+1,837
CaCl2 "Salt Preparation", LANL	6,031	0	0	6,031	0	0
T-Base #2 (D&D and Replacement), LANL	30,500	0	0	0	30,500	+30,500
Install ICP-MS Multi-Collector into RLUOB (Neptune), LANL	6,187	0	1,787	4,400	0	-1,787
Install Introductory Box XB #1, LANL	14,201	0	0	3,033	0	0
Load Frame Installation, LANL	14,475	0	1,392	3,202	9,881	+8,489
MC Upgrades at TFF - GLADOS Lab, LANL	7,596	0	0	7,596	0	0
Drill and Press D&D and Replacement, LANL	24,290	290	0	0	24,000	+24,000
LANL PF-4 Relocated Vault Administrative Area, LANL	5,296	0	0	0	5,296	+5,296
Parts Radiography, LANL	5,000	0	0	0	5,000	+5,000
Tunneling Electron Microscope, LANL	8,000	0	0	8,000	0	0
DUF4 Conversion Line, PPPO	123,780	16,780	15,000	6,000	30,000	+15,000
Replace Three 5-Axis Mills, 12-121, PX	9,812	0	3,312	5,000	1,500	-1,812
High-G Surveillance Testing Centrifuge (WETL, Pantex), SNL	8,700	0	4,800	3,900	0	-4,800
KLA CIRCL with BFI Altair Module (previously KLA2367 Bright Field Inspection Tool), SNL	5,536	0	5,536	0	0	-5,536
Polymide Track & Oven (T&O), SNL	5,625	0	5,625	0	0	-5,625
High Current Ion Implanter, SNL	6,165	0	0	6,165	0	0

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Equipment > $500K (including MIE)						
Solvent Spray System, SNL	6,260	0	0	6,260	0	0
Flexible Production Stepper (previously I-line Multiple Wafer Size Stepper (ASML1 Replacement)), SNL	12,580	0	0	0	0	0
Rapid Thermal Annealing (RTA) Tool, SNL	5,000	0	0	5,000	0	0
Oxide CMP AMAT Mirra MESA, SNL	5,475	0	0	0	0	0
Production Plating Tool (previously Production Plating System), SNL	8,125	0	0	0	8,125	+8,125
SCREEN SU-2000 Backside Clean, SNL	5,500	0	0	0	0	0
3" Capable Production Stepper Tool (previously XLS Stepper Tool - ASML PAS-5500 (GCA4 Replacement)), SNL	8,235	0	0	0	0	0
FSI-Tel Track (ASML1), SNL	10,615	0	0	0	10,615	+10,615
Tonopah Test Range Radar #1, SNL	17,500	0	0	0	17,500	17,500
Tonopah Test Range Radar #2, SNL	17,500	0	0	0	0	0
WB20/WB22 Replacement, SNL	5,100	0	0	0	0	0
CMP Planarization Tool - AMAT Mirra, SNL	5,125	0	0	0	0	0
Diffusion Furnace Replacements (Qty 5), SNL	16,250	0	0	0	0	0
Tritium Extraction Facility (TEF) Spare Furnace, SRS	24,000	0	0	24,000	0	0
Electropolish Equipment (previously Establish Electropolishing Capability), Y-12	6,000	0	6,000	0	0	-6,000
Vapor Degreasing/Ultrasonic Cleaning Station, Y-12	6,000	0	0	6,000	0	0
15 MeV Linatron, 9204-2E, Y-12	6,700	3,300	3,400	0	0	-3,400
Low Temperature Thermal Decomposition (LTTD) Oven, Y-12	7,500	0	7,500	0	0	-7,500
Nuclear Magnetic Resonance (NMR), Y-12	6,089	0	0	2,332	3,757	+3,757
CNC Jig Grinder, Y-12	5,500	0	0	0	0	0
9204-2E Enhanced Backfill Station, Y-12	6,000	0	0	0	6,000	+6,000
Calciner, Y-12	107,817	71,715	27,000	8,555	547	-26,453
Front Loading Furnace, Y12 (Formerly Machine Chip Processing Furnace 1), Y-12	20,200	17,200	3,000	0	0	-3,000

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Equipment > $500K (including MIE)						
Direct Chip Melt Bottom Loading Furnace (formerly Bottom Loading Furnace), Y12[a]	211,600	23,600	7,700	19,863	31,543	+23,843
Electrorefining, Y-12	101,000	89,441	10,421	1,138	0	-10,421
Service Hood System, Y-12	7,645	7,000	645	0	0	-645
Special Materials Equipment, Y-12	30,000	0	0	0	0	0
DUM Direct Cast Production Furnace Execution (formerly Direct Casting Production Furnace), Y-12	32,000	0	0	0	12,000	+12,000
Bldg. 9215 UCl3 STAR, Y-12	7,500	0	1,500	3,000	3,000	+1,500
DUM Foundry Nitric Acid Tank Installation, Y-12	8,100	0	0	8,100	0	0
DUM A2 Wing New Weldbox Installation, Y-12	16,597	0	0	1,597	15,000	+15,000
DUM Rolling Mill Controller Installation, Y-12	9,306	315	2,595	2,500	3,896	+1,301
DUM Rolling Building 9215 High Temperature Salt Bath 350B Installation, Y-12	12,800	0	0	0	12,800	+12,800
DUM Rolling Annealing Furnace Installation, Y-12	20,960	0	0	960	10,000	+10,000
DUM Rolling 9215 Stack 11 Replacement, Y-12 (formerly Stock 11 Replacement, Y-12)	7,000	0	0	7,000	0	0
9204-02 Additional Bird Bath Crystallizer, Y-12	7,500	0	0	7,500	0	0
DUM 9201-01 Vertical Turning Lathe Execution, Y-12	7,000	0	0	3,000	4,000	+4,000
DUM Machining 3 A5NW 5-Axis Machines Execution (PD3M5AME), Y-12	6,000	0	0	0	6,000	+6,000
DUM 9215 P Wing Vacuum Furnace Execution (PD3PWVFE), Y-12	8,000	0	0	0	8,000	+8,000
DUM 3500T Press Control Upgrade, Y-12	12,000	0	0	0	0	0
Machine Dust Transfer Station, Y-12	6,000	0	0	0	0	0
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**301,336**	**494,716**	**460,447**	**+159,111**

[a] Moved from SRT&E to PM in 2021.

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Minor Construction Projects (Total Estimated Cost (TEC)						
Total Minor Construction Projects (TEC <$5M)	N/A	N/A	26,575	27,160	27,757	+597
Establish IT Production Infrastructure @ TA-55, LANL	6,500	1,000	1,500	2,000	2,000	0
Shipping & Receiving (Exterior), LANL	12,500	0	2,800	9,700	0	-9,700
Increase Positive Personal Identity Verification (PPIV) Booth Capacity (East Entry Control Facility), LANL	12,000	0	0	0	12,000	+12,000
TA-03-0040-E39 3D Printing Room, LANL	9,625	0	0	0	9,625	+9,625
Quench furnace infrastructure and space buildout, LLNL	10,500	0	0	10,500	0	-10,500
DAF Glovebox Exhaust System for expanded glovebox operations, LLNL	10,000	0	0	10,000	0	-10,000
DAF Deployment Project, NNSS	7,300	0	2,500	3,100	1,700	-1,400
Demonstration Cascade 2 (DCAS2), ORNL[a]	19,000	0	19,000	0	0	0
Reliable Dry Room Installation and Li Battery Pack Rapid Prototyping Lab Installation, SNL	12,000	1,100	10,900	0	0	0
Install Mini-TCAP in TEF, SRS	15,645	0	0	1,145	0	-1,145
Redesign TEF Mass Spec 4 Location And purchase new Mass Spec for TEF, SRS	8,600	0	0	2,100	6,500	+4,400
Install HT-TCAP Feed/Product Transfer Lines, SRS	6,000	0	0	0	6,000	+6,000
Module Stripper Blower Redesign/Replacement, SRS	7,750	0	0	0	750	+750
Glovebox Stripper Blower Redesign/Replacement, SRS	7,000	0	0	0	2,000	+2,000
Worker Protection System (WPS) Programmable Logic Controller (PLC) to Delta V Conversion, SRS	6,250	0	0	0	0	0
Waste Container Handling Area, SRS	11,262	0	0	0	3,697	+3,697
Pu Metallography Capability, SRS	5,000	0	0	0	1,000	+1,000
Modularize Salvage Operations, Y-12	8,000	0	2,500	3,000	2,500	-500
LiM 9204-02 Equipment Removal, Y-12	7,000	0	1,000	5,000	1,000	-4,000
9215 Liquid Transfer Station, Y-12	7,000	0	0	300	6,700	+6,400
9204-2E Liquid Transfer Station, Y-12	7,000	0	0	300	6,700	+6,400
9995 Liquid Transfer Station, Y-12	7,000	0	0	300	6,700	+6,400
Drying Oven #3, Y-12	5,200	0	0	0	5,200	+5,200
A-2 Wing/ 9212 Decoupling, Y-12	8,311	0	0	0	1,185	+1,185
9212 Decon/ Sort & Seg Facility, Y-12	7,958	2,111	397	3,491	1,959	-1532
LiM 9204-02 Lithium Process Equipment Relocation, Y-12	6,500	500		1,000	5,000	+4,000
LiM Lithium Lab Area Upgrades Y-12	14,000	0	0	0	14,000	14000
LiM 9204-2 Redundant Crusher Grinder Installation Y-12	11,000	0	0	0	11,000	11000
Building 9215 Complex Integration with Bottom Loading Furnace, Y-12	7,582	0	0	0	182	+182
Total, Minor Construction Projects	**N/A**	**N/A**	**67,172**	**79,096**	**135,155**	**+55,877**
Total, Capital Summary	**N/A**	**N/A**	**368,508**	**573,812**	**595,602**	**+214,988**

[a] Project design began in FY 2021 and was halted due to lack of notification. No further work will occur until notification and the wait period is complete. Full funding was provided in FY 2021 to ensure no funding delays.

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
	(Dollars in Thousands)				
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))					
Capital Equipment >$500K (including MIE)	354,259	291,640	216,786	209,829	N/A
Minor Construction	66,459	43,992	29,630	36,032	N/A
Total, Capital Operating Expenses	**420,718**	**335,632**	**246,416**	**245,861**	**N/A**
Capital Equipment > $500K (including MIE)					
Total Non-MIE Capital Equipment (>$500K and <$5M)	140,816	143,914	147,081	150,316	N/A
DAF Pit Certification support gloveboxes, LLNL	0	7,100	0	0	0
DAF pit residue processing gloveboxes, LLNL	0	0	8,600	0	0
DAF End of Life equipment replacement, LLNL	0	0	0	13,500	0
Subassembly Installation, LANL	0	7,214	0	0	0
Machining Parts Staging #2, LANL	12,127	0	0	0	0
Foundry Immersion Density, LANL	0	0	0	4,763	0
Turnings Consolidation glovebox (Previously Install new turnings consolidation glovebox), LANL	35,000	0	0	0	0
Aqueous Nitrate Evaporator Upgrades (Prevously AQ-Nitrate Upgrades), LANL	12,336	0	0	0	0
Aqueous Nitrate Cement Fixation Upgrades, LANL	12,689	0	0	0	0
PPCW (Positive Pressure Chilled Water Upgrades) (Previously Chilled Water and Compressed Air), LANL	0	6,505	0	0	0
Process Compressed Air Upgrades (PCA), LANL	0	6,909	0	0	0
TIMS #3 into RLUOB, LANL	5,756		0	0	0
Size Reduction Press GB Installation, LANL	0	11,295	0	0	0
Manufacturing Modernization Project (MMP), LANL	0	11,168	0	0	0
DUF4 Conversion Line, PPPO	23,000	23,000	10,000	0	0
Replacement)), SNL	0	0	12,580	0	0
Oxide CMP AMAT Mirra MESA, SNL	0	5,475	0	0	0
SCREEN SU-2000 Backside Clean, SNL	5,500	0	0	0	0
Replacement)), SNL	8,235	0	0	0	0
Tonopah Test Range Radar #2, SNL	17,500	0	0	0	0
WB20/WB22 Replacement, SNL	5,100	0	0	0	0
CMP Planarization Tool - AMAT Mirra, SNL	0	0	5,125	0	0
Diffusion Furnance Replacements (Qty 5), SNL	0	0	0	16,250	0
CNC Jig Grinder, Y-12	0	5,500	0	0	0
Bottom Loading Furnace, Y12	26,200	35,560	33,400	25,000	8,734
Special Materials Equipment, Y-12	30,000		0	0	0
DUM Direct Cast Production Furnace Execution (formerly Direct Casting Production Furnace), Y-12	10,000	10,000	0	0	0
DUM Rolling Annealing Furnace Installation, Y-12	10,000	0	0	0	0
DUM 3500T Press Control Upgrade, Y-12	0	12,000	0	0	0
Machine Dust Transfer Station (ROT), Y-12	0	6,000	0	0	0
Total, Capital Equipment (including MIE)	**354,259**	**291,640**	**216,786**	**209,829**	**N/A**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
	(Dollars in Thousands)				
Minor Construction Projects (Total Estimated Cost (TEC)					
Total Minor Construction Projects (TEC <$5M)	28,368	28,992	29,630	30,282	N/A
Install Mini-TCAP in TEF, SRS	0	14,500	0	0	0
Module Stripper Blower Redesign/Replacement, SRS	7,000	0	0	0	0
Glovebox Stripper Blower Redesign/Replacement, SRS	5,000	0	0	0	0
Worker Protection System (WPS) PLC to Delta V Conversion, SRS	0	500	0	5,750	0
Waste Container Handling Area, SRS	7,565	0	0	0	0
773A Pu Metallography Capability, SRS	4,000	0	0	0	0
A-2 Wing/ 9212 Decoupling, Y-12	7,126	0	0	0	0
Building 9215 Complex Integration with Bottom Loading Furnace, Y-12	7,400	0	0	0	0
Total, Minor Construction Projects	**66,459**	**43,992**	**29,630**	**36,032**	**N/A**
Total, Capital Summary	**420,718**	**335,632**	**246,416**	**245,861**	**N/A**

Production Modernization
Construction Project Summary

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
Production Modernization						
23-D-516, Energetic Materials Characterization Facility, LANL						
TEC	334,618	0	0	0	19,000	19,000
OPC	17,242	6,860	0	0	0	0
TPC, 23-D-516, Energetic Materials Characterization Facility, LANL	**351,860**	**6,860**	**0**	**0**	**19,000**	**19,000**
22-D-513, Power Sources Capability, SNL						
TEC	323,327	0	0	13,827	0	-13,827
OPC	37,005	3,000	6,000	800	800	0
TPC, 22-D-513, Power Sources Capability, SNL	**360,332**	**3,000**	**6,000**	**14,627**	**800**	**-13,827**
21-D-512, Plutonium Pit Production Project, LANL						
TEC	3,209,209	0	226,000	345,000	547,234	+202,234
OPC	389,325	60,000	0	5,000	41,000	+36,000
Total Project Cost, 21-D-512, Plutonium Pit Production Project, LANL	**3,598,534**	**60,000**	**226,000**	**350,000**	**588,234**	**+238,234**
21-D-511, Savannah River Plutonium Processing Facility, SRS						
TEC	8,919,766	0	241,896	459,000	670,000	+211,000
OPC	2,180,234	311,213	110,000	16,000	30,000	14,000
Total Project Cost, 21-D-511, Savannah River Plutonium Processing Facility, SRS	**11,100,000**	**311,213**	**351,896**	**475,000**	**700,000**	**+225,000**
21-D-510 HE Synthesis, Formulation, and Production, PX						
TEC	630,460	0	30,600	44,500	108,000	+63,500
OPC	30,600	6,793	400	0	0	0
TPC, 21-D-510 HE Synthesis, Formulation, and Production, PX	**661,060**	**6,793**	**31,000**	**44,500**	**108,000**	**+63,500**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
18-D-690, Lithium Processing Facility, Y-12						
TEC	1,545,000	51,000	99,405	164,902	213,886	+48,984
OPC[a]	100,000	11,424	10,000	3,000	3,000	0
TPC, 18-D-690, Lithium Processing Facility, Y-12	**1,645,000**	**62,424**	**109,405**	**167,902**	**216,886**	**+48,984**
18-D-680, Material Staging Facility, PX						
TEC	144,200	29,200	0	0	0	0
OPC	4,000	4,000	0	0	0	0
TPC, 18-D-680, Material Staging Facility, PX	**148,200**	**33,200**	**0**	**0**	**0**	**0**
18-D-650, Tritium Finishing Facility, SRS						
TEC	562,300	27,000	27,000	27,000	73,300	+46,300
OPC[b]	77,700	9,700	2,000	2,000	0	-2,000
TPC, 18-D-650, Tritium Finishing Facility, SRS	**640,000**	**36,700**	**29,000**	**29,000**	**73,300**	**+44,300**
15-D-302, TA-55 Reinvestment Project Phase III, LANL						
TEC	187,914	34,438	30,000	27,000	30,002	+3,002
OPC	47,143	11,088	2,000	5,000	11,000	+6,000
TPC, 15-D-302, TA-55 Reinvestment Project Phase III, LANL	**235,057**	**45,526**	**32,000**	**32,000**	**41,002**	**+9,002**
15-D-301, HE Science & Engineering Facility, PX						
TEC	213,628	92,272	43,000	0	20,000	20,000
OPC	14,372	2,870	3,750	0	0	0
TPC, 15-D-301, HE Science & Engineering Facility, PX	**228,000**	**95,142**	**46,750**	**0**	**20,000**	**+20,000**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
07-D-220-04, Transuranic Liquid Waste Facility, LANL						
TEC[a]	193,228	92,849	36,687	30,000	24,759	-5,241
OPC	22,099	3,234	1,000	3,000	4,000	+1,000
TPC, 07-D-220-04, Transuranic Liquid Waste Facility, LANL	**215,327**	**96,083**	**37,687**	**33,000**	**28,759**	**-4,241**
06-D-141, Uranium Processing Facility, Y-12						
TEC	6,121,337	4,564,748	718,500	546,500	219,000	-327,500
OPC	378,663	100,663	31,500	53,500	143,000	+89,500
TPC, 06-D-141, Uranium Processing Facility, Y-12	**6,500,000**	**4,665,411**	**750,000**	**600,000**	**362,000**	**-238,000**
04-D-125, Chemistry and Metallurgy Research Replacement, LANL						
TEC	2,357,220	1,610,381	115,093	110,970	162,012	+51,042
OPC	421,340	281,833	54,334	27,153	0	-27,153
TPC, 04-D-125, Chemistry and Metallurgy Research Replacement, LANL	**2,778,560**	**1,892,214**	**169,427**	**138,123**	**162,012**	**+23,889**
Total, Production Modernization						
TEC	**24,742,207**	**6,501,888**	**1,568,181**	**1,768,699**	**2,087,193**	+318,494
OPC	**3,719,723**	**812,678**	**220,984**	**115,453**	**232,800**	+117,347
TPC Total, Production Modernization	**28,461,930**	**7,314,566**	**1,789,165**	**1,884,152**	**2,319,993**	**+435,841**

[a] Lithium Processing Facility OPCs are funded under Lithium Modernization in FY 2020 and the prior years.

[b] Tritium Finishing Facility OPCs are funded under Tritium Sustainment in FY 2020 and the outyears. 18-D-650 became Tritium Finishing Facility in FY 2020.

[a] Reflects recission of $28,013 in FY 2017; In FY 2018, reflects an internal reprogramming from 12-D-301, Transuranic Waste Facilities, LANL project to this project for continued design activities conducted by the U.S. Army Corps of Engineers.

	(Dollars in Thousands)				
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
Production Modernization					
23-D-516, Energetic Materials Characterization Facility, LANL					
TEC	29,000	107,000	136,000	43,000	618
OPC	0	0	5,000	5,382	0
TPC, 23-D-516, Energetic Materials Characterization Facility, LANL	**29,000**	**107,000**	**141,000**	**48,382**	**618**
22-D-513, Power Sources Capability, SNL					
TEC	37,886	71,083	43,902	44,824	111,805
OPC	2,200	4,000	5,705	4,000	10,500
TPC, 22-D-513, Power Sources Capability, SNL	**40,086**	**75,083**	**49,607**	**48,824**	**122,305**
21-D-512, Plutonium Pit Production Project, LANL					
TEC	617,000	593,160	563,515	305,000	12,300
OPC	53,000	66,840	61,485	60,000	42,000
Total Project Cost, 21-D-512, Plutonium Pit Production Project, LANL	**670,000**	**660,000**	**625,000**	**365,000**	**54,300**
21-D-511, Savannah River Plutonium Processing Facility, SRS					
TEC	828,235	984,508	1,001,339	877,000	3,857,788
OPC	30,000	30,000	50,000	75,000	1,528,021
Total Project Cost, 21-D-511, Savannah River Plutonium Processing Facility, SRS	**858,235**	**1,014,508**	**1,051,339**	**952,000**	**5,385,809**
21-D-510 HE Synthesis, Formulation, and Production, PX					
TEC	162,000	211,000	74,360	0	0
OPC	0	1,000	22,407	0	0
TPC, 21-D-510 HE Synthesis, Formulation, and Production, PX	**162,000**	**212,000**	**96,767**	**0**	**0**

	(Dollars in Thousands)				
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
18-D-690, Lithium Processing Facility, Y-12					
TEC	250,770	264,000	270,000	228,000	3,037
OPC	10,000	16,000	20,000	22,000	4,576
TPC, 18-D-690, Lithium Processing Facility, Y-12	**260,770**	**280,000**	**290,000**	**250,000**	**7,613**
18-D-680, Material Staging Facility, PX					
TEC	0	0	15,000	100,000	0
OPC	0	0	0	0	0
TPC, 18-D-680, Material Staging Facility, PX	**0**	**0**	**15,000**	**100,000**	**0**
18-D-650, Tritium Finishing Facility, SRS					
TEC	92,200	105,700	89,200	66,200	54,700
OPC	8,000	10,500	11,000	10,000	24,500
TPC, 18-D-650, Tritium Finishing Facility, SRS	**100,200**	**116,200**	**100,200**	**76,200**	**79,200**
15-D-302, TA-55 Reinvestment Project Phase III, LANL					
TEC	30,000	34,474	2,000	0	0
OPC	11,808	5,700	547	0	0
TPC, 15-D-302, TA-55 Reinvestment Project Phase III, LANL	**41,808**	**40,174**	**2,547**	**0**	**0**
15-D-301, HE Science & Engineering Facility, PX					
TEC	58,356	0	0	0	0
OPC	5,787	1,965	0	0	0
TPC, 15-D-301, HE Science & Engineering Facility, PX	**64,143**	**1,965**	**0**	**0**	**0**

	(Dollars in Thousands)				
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
07-D-220-04, Transuranic Liquid Waste Facility, LANL					
TEC	8,933	0	0	0	0
OPC	6,230	4,635	0	0	0
TPC, 07-D-220-04, Transuranic Liquid Waste Facility, LANL	**15,163**	**4,635**	**0**	**0**	**0**
06-D-141, Uranium Processing Facility, Y-12					
TEC	72,589	0	0	0	0
OPC	50,000	0	0	0	0
TPC, 06-D-141, Uranium Processing Facility, Y-12	**122,589**	**0**	**0**	**0**	**0**
04-D-125, Chemistry and Metallurgy Research Replacement, LANL					
TEC	248,917	109,847	0	0	0
OPC	0	58,020	0	0	0
TPC, 04-D-125, Chemistry and Metallurgy Research Replacement, LANL	**248,917**	**167,867**	**0**	**0**	**0**
Total, Production Modernization					
TEC	**2,435,886**	**2,480,772**	**2,195,316**	**1,664,024**	**4,040,248**
OPC	**177,025**	**198,660**	**176,144**	**176,382**	**1,609,597**
TPC Total, Production Modernization	**2,612,911**	**2,679,432**	**2,371,460**	**1,840,406**	**5,649,845**

23-D-516, Energetic Materials Characterization Facility
Los Alamos National Laboratory (LANL), Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The Energetic Materials Characterization Facility Project (EMC) will support the nuclear weapons design and detonator production missions and provide the capability to perform high explosive, energetics characterization, analysis and testing, as well as replace aging, obsolete facilities. The FY 2023 Request for EMC is $19,000K in Total Estimated Cost (TEC) funding to initiate preliminary design. The current Critical Decision (CD-0) was approved on April 2, 2020 by the NNSA Administrator. The Analysis of Alternatives (AoA) Team developed the Total Project Cost (TPC) estimate as a range, resulting in a $351,860K TPC and a CD-4 in FY 2030. This range and funding will be updated at CD-1. A Federal Project Director has been assigned to this project and has approved this construction project data sheet (CPDS).

Significant Changes

This project is a new start in FY 2023. The EMC project received CD-0 in April 2020. Program Management Executive (PME) authority was delegated April 2, 2020 to the DADP (NA-10). An AoA study was subsequently conducted and resulted in the recommendation of the three building approach. This selected option indicated a cost range of $200M - $410M for the three building alternative. On July 30, 2021, 100% conceptual design was completed. An initial cost estimate was developed based on the conceptual design. This cost estimate is pending external review.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2023	4/2/2020	7/30/2021	1Q FY2023	4Q FY2025	4Q FY2024	4Q FY2025	N/A	2Q FY2030

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable).
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete –Completion of D&D work
CD-4 – Approve Start of Operations or Project Complete

Project Cost History ($K)

Fiscal Year	TEC, Design	TEC, Construction	TEC Total	OPC, Except D&D	OPC, D&D	OPC Total,	TPC
FY 2023	48,000	286,618	334,618	17,242	0	17,242	351,860

2. Project Scope and Justification

Scope

The EMC Project is a facility design and construction project. The project will replace 18 aging and/or obsolete facilities housing high explosive (HE) characterization and analysis laboratories with a new, integrated facility campus. The conceptual design includes three buildings: 1) A single story 59,000 ft^2 High Explosives Characterization/Detonator Laboratory constructed of cast-in-place concrete, 2) A two story 29,000 ft^2 office building based on modular construction techniques providing approximately 107 office spaces and 3) 2,000 ft^2 HE storage capacity (magazines). Associated infrastructure (parking, connecting walkways, utilities, and associated site modifications for facility access) are also included in project scope.

Justification

Energetic Materials (EM), including HE, are vital components of nuclear weapons. EM characterization, analysis, testing, and production are needed to ensure the safety, security, and effectiveness of the U.S. nuclear weapons stockpile. Specifically, this characterization includes evaluation of the safety and performance characteristics of both extant and new formulations of EM, understanding pathways for material degradation, chemical composition analysis, and performance and aging tests.

These aspects of EM technology are essential for the development, production, and evaluation of existing stockpile materials, components, and the identification and selection of new formulations for future nuclear weapons applications. Currently, Los Alamos National Laboratory (LANL) accomplishes the EM characterization operations in 18 aging facilities, many of which are plagued by mechanical, structural, electrical, and safety system issues.

Current infrastructure that is actively supporting the EM characterization, analysis, testing, and production mission is failing resulting in direct impact to the ability to conduct work. A lack of temperature control, compressed air, frequent power outages resulting in equipment failure, and inadequate power distribution are causing degradation of HE science. The aging and faulty infrastructure has caused loss of experimental data, failure of environmentally and time sensitive experiments, significant worker inefficiency and mandatory overtime efforts, as well as an inability to conduct legacy characterization experiments. If not addressed, inoperable and failing equipment coupled with increased dependence on administrative safety controls will progressively increase risk of safety failures. Unreliable systems in inflexible and congested laboratory spaces will cause high to unacceptable programmatic risks. Significantly more program funding will have to be diverted to deferred maintenance until facilities completely fail, ultimately impacting the overarching mission goals.

The primary objective of the EMC Project is to design and construct a Laboratory, Office and HE storage integrated campus which will provide the capability to perform HE energetics characterization, analysis, and testing to support the nuclear weapons design and detonator production missions. This consolidated facility will include modern engineered safety controls, reliable utilities and temperature controlled environments needed for effective HE science, flexible spaces and systems to allow staff to incorporate new techniques and systems, and the improved overall ability for staff to work in a safe productive environment.

Contingency has been allocated as a percentage of the base cost from the parametric class five estimate. The project has initialized risk assessment activities and is pursuing qualitative and quantitative risk analysis to support the development of more specific cost estimates based on mature risk analysis.

Funds appropriated under this CPDS may be used for contracted support services to the Federal Program Manager and the Federal Project Director to conduct independent assessments of the planning and execution of this project required by DOE O 413.3B and to conduct technical reviews of design and construction documents. The Project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. As allowed by the Order, the Critical Decision process will be tailored by combining CD-2, *Approve Performance Baseline*, and CD-3, *Approve Start of Construction/Execution*, into a single CD-2/3 authorization to improve overall Project efficiency and to reduce the time required to achieve Facility beneficial occupancy.

Key Performance Parameters (KPPs)

KPPs were established at CD-0 that consider material development, transportation, characterization and qualification of HE for the stockpile and that provide a capability appropriate to the development of novel materials and the implementation of new technologies. Achievement of the threshold KPPs is a prerequisite for approval of CD-4, *Project Completion*. Threshold and Objective KPPs will be included in the CD-1 package.

- **KPP-1, Material Characterization, Qualification, and Transportation Support:** The capability will allow for chemical and physical characterization necessary to meet War Reserve analytical criteria and provide provenance for energetic materials with respect to technical specifications.
- **KPP-2, Novel Process and Material Development:** Parameters related to supporting facilities and infrastructure shall be optimized during design.

3. Financial Schedule ($K)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2023	19,000	19,000	16,150
FY 2024	29,000	22,990	22,990
FY 2025	0	6,010	8,860
Total Design	48,000	48,000	48,000
Construction			
FY 2025	107,000	38,194	38,194
FY 2026	136,000	65,258	65,258
FY 2027	43,000	47,761	47,761
FY 2028	618	30,843	30,843
FY 2029	0	63,728	63,728
FY 2030	0	40,834	40,834
Total Construction	286,618	286,618	286,618
Total Estimated Costs (TEC)			
FY 2023	19,000	19,000	16,150
FY 2024	29,000	22,990	22,990
FY 2025	107,000	44,204	47,054
FY 2026	136,000	65,258	65,258
FY 2027	43,000	47,761	47,761
FY 2028	618	30,843	30,843
FY 2029	0	63,728	63,728
FY 2030	0	40,834	40,834
Total TEC	**334,618**	**334,618**	**334,618**
Other Project Costs (OPC)			
FY 2020	212	212	212
FY 2021	3,981	3,981	3,981
FY 2022	2,667	2,667	2,667
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	0	0	0
FY 2026	5,000	2,000	2,000
FY 2027	5,382	2,500	2,500
FY 2028	0	3,000	3,000
FY 2029	0	2,500	2,500
FY 2030	0	382	382
Total OPC	**17,242**	**17,242**	**17,242**

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Costs (TPC)			
FY 2020	212	212	212
FY 2021	3,981	3,981	3,981
FY 2022	2,667	2,667	2,667
FY 2023	19,000	19,000	16,150
FY 2024	29,000	22,990	22,990
FY 2025	107,000	44,204	47,054
FY 2026	141,000	67,258	67,258
FY 2027	48,382	50,261	50,261
FY 2028	618	33,843	33,843
FY 2029	0	66,228	66,228
FY 2030	0	41,216	41,216
Grand Total	**351,860**	**351,860**	**351,860**

4. Details of Project Cost Estimate ($K)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	35,556	N/A	N/A
Contingency	12,444	N/A	N/A
Total Design	48,000	N/A	N/A
Construction			
Site Work	15,016	N/A	N/A
Equipment	39,136	N/A	N/A
Construction	100,876	N/A	N/A
Title III Services	6,778	N/A	N/A
Oversight & Management	52,259	N/A	N/A
Contingency	72,553	N/A	N/A
Total Construction	286,618	N/A	N/A
TOTAL TEC	**334,618**		
Contingency - TEC	**84,997**	N/A	N/A
Other Project Costs (OPC)			
Conceptual Design	6,995	N/A	N/A
Startup/Turnover to Operations	5,850	N/A	N/A
Contingency	4,397	N/A	N/A
TOTAL OPC	17,242		
Contingency - OPC	4,397	N/A	N/A
TOTAL PROJECT COSTS (TPC)	**351,860**		
Contingency – TPC (TEC+OPC)	**89,394**	N/A	N/A

5. Schedule of Appropriations Requests ($K)

Request Year	Type	Prior Years	FY2023	FY2024	FY2025	FY2026	FY2027	Out Years	Total
FY2023	TEC	0	19,000	29,000	107,000	136,000	43,000	618	334,618
	OPC	6,860	0	0	0	5,000	5,382	0	17,242
	TPC	**6,860**	**19,000**	**29,000**	**107,000**	**141,000**	**48,382**	**618**	**351,860**

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	2Q FY2030
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	2Q FY2080

Related Funding Requirements ($M)

Funding Requirements	Annual Costs		Life Cycle Costs	
Estimate Totals	**Previous Estimate**	**Current Estimate**	**Previous Estimate**	**Current Estimate**
Operations and Maintenance	N/A	$203	N/A	$10,140

7. D&D Information

The new area being constructed in this project is replacing existing facilities. The D&D of these existing facilities is not a part of the EMC Project. Future use or demolition of existing facilities will be individually considered due to proximity and plausible inclusion on National Historic Park under development in the vicinity.

8. Acquisition Approach

The EMC Project acquisition strategy assigns project execution to the LANL Management and Operating (M&O) Contractor, Triad National Security, LLC. Based on the specific business case for each major element of scope, Triad will submit procurement planning information for approval to NNSA which will represent an optimal procurement strategy and best value to the government.

15-D-301 High Explosive Science and Engineering (HESE) Facility
Pantex Plant, Amarillo, Texas
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2023 Request for the High Explosive Science and Engineering (HESE) Facility is $20,000,000. The most recent DOE O 413.3B approved Critical Decisions (CD) are CD-3A, *Approve Site Preparation and Long Lead Procurement*, with a cost of $23,300,000 and a completion of 2nd Quarter FY 2023 and CD-2/3, *Approve Performance Baseline and Start of Construction*, with a Total Project Cost (TPC) of $228,000,000 and a CD-4 date of November 2027. The projected schedule that was established at CD-1 has been revised with the start of construction moving from 1st Quarter FY 2018 to 3rd Quarter FY 2022, due to the project being placed "on hold" for three years and a delay in receiving a construction contract bid. This submission increases the TPC identified in the FY 2021 project data sheet from $195,497,000 to $228,000,000 based on supply chain and market conditions affecting the value of construction bids compared to initial estimates in FY 2020. Pursuant to 50 U.S.C. § 2744, *Limits on Construction Projects*, this submission notifies Congress of the cost increase for the project. The increase exceeds by more than 25 percent the amount of the total estimated cost (TEC) shown in the fiscal year (FY) 2021 President's Budget Request. The TEC has increased 58 percent, from $135,272,000 for FY 2021 to $213,628,000 for FY 2023.

This FY 2023 Request also documents the removal of the demolition and disposal (D&D) scope of the project and reallocates the planned OPC funding to TEC to support increased construction costs. The construction contract award is planned for 3rd Quarter FY 2022. The Performance Baseline was informed by an Independent Cost Estimate (ICE) and an External Independent Review (EIR) that were completed in June 2020 and were supplemented prior to CD-2/3approval. The FY 2023 Request includes funds to continue the construction of the facility.

While Congress appropriated funds for OPC in a separate "HESE OPC" control in FY 2021, funds for OPCsare included as part of the High Explosives and Energetics program in FY 2024 and 2025 of the FY 2023-2027 FYNSP.

Significant Changes:
This Construction Project Data Sheet (CPDS) is an update of the Fiscal Year (FY) 2021 CPDS and does not include a new start for the budget year. This CPDS provides notification of a change in execution strategy for the project, with CD-3A having occurred October 30, 2020 to optimize the project schedule, the removal of the demolition and disposal (D&D) from the project scope, a shift in OPC funding into the FYNSP, and an increase in TEC funding.

Preliminary and Final Design were completed in July 2018 before the project was placed on hold awaiting construction funding, which was deferred to accommodate higher priority projects. Due to the length of time between design completion and receipt of construction funding, design revalidation efforts were completed in FY 2021, with several code updates, but no major changes to the overall design, before construction could begin. CD-3A for site preparation and long lead procurement was approved October 30, 2020. The D&D was removed from the project as identified in section 7.

A Federal Project Director is currently assigned to this project.

Critical Milestone History[a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2015	11/22/2011	N/A	4Q FY 2014	4Q FY 2015	3Q FY 2016	4Q FY 2016	3Q FY 2020	3Q FY 2020
FY 2016	11/22/2011	1/9/2015	1/09/2015	1Q FY 2018	4Q FY 2017	1Q FY 2018	3Q FY 2023	4Q FY 2023
FY 2020	11/22/2011	1/9/2015	1/09/2015	3Q FY 2020	2Q FY 2020[b]	3Q FY 2020	3Q FY 2025	4Q FY 2025
FY 2021	11/22/2011	1/9/2015	1/09/2015	4Q FY 2020	3Q FY 2020[a]	4Q FY 2020	3Q FY 2025	4Q FY 2025
FY 2023	11/22/2011	1/9/2015	1/09/2015	4/13/2022	8/17/2020[a]	4/13/2022	N/A	1Q FY 2028

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2023	4/12/2022	10/30/2020

CD-3A – Approve Site Preparation and Long-Lead Procurement

Project Cost History

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	11,800	60,500	72,300	6,100	18,600	24,700	97,000
FY 2016	14,249	83,051	97,300	21,055	36,124	57,179	154,479
FY 2020	15,372	119,900	135,272	12,025	48,200	60,225	195,497
FY 2021	15,372	119,900	135,272	12,025	48,200	60,225	195,497
FY 2023	18,497	195,131	213,628	14,372	N/A	14,372	228,000

2. Project Scope and Justification

Scope[c]

The project will build three structures totaling 68,500 square feet with associated weather-proofed ramps totaling 4,000 square feet. These structures will replace the aging facilities in Zone 11 with new facilities that meet current codes and standards and better support program requirements:

- HE Laboratory: Equipment and facility will be designed to sustain an HE loading of 12 lb (±15%) HE equivalent. (28,000 square feet)
- HE Staging: Equipment and facility will be designed to sustain 50 lb (±15%) HE equivalent for temporary storage. (500 square feet)

[a] The schedules are estimates and consistent with the high end of the schedule ranges.
[b] The final design was completed on 7/27/2018, but this represents the completion of design revalidation.
[c] All square foot values have been rounded to the nearest 500 SF.

- Technology Development and Deployment Laboratory: Provide necessary laboratory space for approximately 73 personnel to support the weapons complex mission. (40,000 square feet)

Justification
Currently HE S&E personnel, as well as laboratory operations, are located in 15 separate facilities which are, on average, more than 60 years old. The existing facilities are not constructed for today's operations or HE limits, and their distribution across Zone 11 does not provide for efficient work processes. The distance between facilities increases travel time for personnel and materials back and forth, which adds additional cost to operations. In addition, safety, security, and environmental issues associated with these aging facilities are mounting, as are the costs of addressing them.

Current HE capacity limits prohibit quantities greater than a small amount create inefficient operations in several of the laboratories. HE limits mandate additional moves of HE to various facilities as well as to maintain safe separation limits. The HE capacity limitations are primarily due to the original design and structure of the old facilities. The numerous HE handling activities required to load, unload and move the HE increase potential safety hazards.

This project provides the following additional benefits in support of HE Manufacturing:

- Computational and experimental capability
- Capability to develop diagnostic tools for the evaluation, manufacturing support, surveillance, and testing of materials
- Capability to conduct technology development in modern facilities (most existing facilities that provide these capabilities are over 60 years old)
- Separate classified and non-classified spaces, increasing efficiency and lowering Information Security risk

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. Funds appropriated under this data sheet may be used to provide independent assessments for planning and execution of this project, and contracted support services to the federal project team for oversight and support.

Key Performance Parameters (KPPs)
The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure
HE Laboratory: HE Operational Limit of 12 pounds
HE Staging: HE Operational Limit of 50 pounds
Technology Development and Deployment Laboratory: Accommodate approximately 73 personnel in the laboratory space; minimum number of 64, but no more than 85

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2015	11,800	11,760	61
FY 2016	0	-11	1,515

	Budget Authority (Appropriations)	Obligations	Costs
FY 2017	-28[a]	0	5,106
FY 2018	500[b]	519	4,041
FY 2019	0	-1,084[c]	-7[d]
FY 2020	3,100	4,188	4,282
FY 2021	3,125	3,125	1,585
FY 2022	0	0	1,914
Total, Design	**18,497**	**18,497**	**18,497**
Construction			
FY 2020	76,900	76,900	0
FY 2021	39,875	39,875	10,200
FY 2022	0	0	21,200
FY 2023	20,000	20,000	95,600
FY 2024	58,356	58,356	66,950
FY 2025	0	0	1,181
Total, Construction	**195,131**	**195,131**	**195,131**
Total Estimated Costs			
FY 2015	11,800	11,760	61
FY 2016	0	-11	1,515
FY 2017	-28	0	5,106
FY 2018	500	519	4,041
FY 2019	0	-1,084	-7
FY 2020	80,000	81,088	4,282
FY 2021	43,000	43,000	11,785
FY 2022	0	0	23,114
FY 2023	20,000	20,000	95,600
FY 2024	58,356	58,356	66,950
FY 2025	0	0	1,181
Total, TEC	**213,628**	**213,628**	**213,628**
Other Project Costs			
FY 2013	1,790	1,790	200
FY 2014	750	750	1,200
FY 2015	100	100	400
FY 2016	100	100	0
FY 2017	0	0	0

[a] Reflects rescission of $28,013 in FY 2017.

[b] Reflects an internal reprogramming from 12-D-301, Transuranic Waste Facilities, LANL project to this project for continued design activities conducted by the U.S. Army Corps of Engineers.

[c] Reflects result of deobligations that occurred during FY 2019 on AY 2015 funding.

[d] Reflects a credit that occurred during FY 2019 execution.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	130	130	0
FY 2021	3,750	3,750	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	5,787	5,787	3,725
FY 2025	1,965	1,965	5,550
FY 2026	0	0	3,297
Total, OPC	**14,372**	**14,372**	**14,372**
Total Project Costs (TPC)			
FY 2013	1,790	1,790	200
FY 2014	750	750	1,200
FY 2015	11,900	11,860	461
FY 2016	100	89	1,515
FY 2017	-28	0	5,106
FY 2018	500	519	4,041
FY 2019	0	-1,084	-7
FY 2020	80,130	81,218	4,282
FY 2021	46,750	46,750	11,785
FY 2022	0	0	23,114
FY 2023	20,000	20,000	95,600
FY 2024	64,143	64,143	70,675
FY 2025	1,965	1,965	6,731
FY 2026	0	0	3,297
Grand Total	**228,000**	**228,000**	**228,000**[a]

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	17,997	13,572	17,847
Federal Support	500	1,300	500

[a] The project spend plan is less than the funding request and will be updated as the Performance Baseline is approved at CD-2/3 in 3Q FY 2022.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Contingency	0	500	150
Total, Design	18,497	15,372	18,497
Construction			
Site Work	14,541	9,600	14,541
Equipment	4,450	5,000	4,450
Construction	147,930	86,000	147,930
Federal Support	3,410	2,600	3,410
Contingency	24,800	16,700	24,800
Total, Construction	195,131	119,900	195,131
Total, TEC	**213,628**	**135,272**	**213,628**
Contingency, TEC	*24,950*	*17,200*	24,950
Other Project Cost (OPC)			
OPC except D&D			
Analysis of Alternatives	200	200	200
Conceptual Design	1,600	1,600	1,600
Start-up (Transition to Operations)	9,482	3,200	9,482
Equipment and Moves	1,590	4,800	1,590
Contingency	1,500	2,225	1,500
Total, OPC except D&D	14,372	12,025	14,372
OPC D&D			
Demolition	0	18,000	0
Utility Relocation	0	20,600	0
Contingency	0	9,600	0
Total, OPC D&D	0	48,200	0
Total, OPC	**14,372**	**60,225**	**14,372**
Contingency, OPC	*1,500*	*11,825*	1,500
Total Project Cost	**228,000**	**195,497**	**228,000**
Total Contingency (TEC+OPC)	***26,450***	***29,025***	**26,450**

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2022	FY 2023	FY 2024	FY 2025	Total
FY 2015	TEC	72,300	0	0	0	0	72,300
	OPC	24,700	0	0	0	0	24,700
	TPC	97,000	0	0	0	0	97,000
FY 2016	TEC	96,456	0	0	0	0	96,456
	OPC	36,945	0	0	20,234	0	57,179
	TPC	133,401	0	0	20,234	0	153,635
FY 2020	TEC	135,272	0	0	0	0	135,272
	OPC	6,620	3,750	19,655	30,200	0	60,225

Request Year	Type	Prior Years	FY 2022	FY 2023	FY 2024	FY 2025	Total
	TPC	141,892	3,750	19,655	30,200	0	195,497
FY 2021	TEC	135,272	0	0	0	0	135,272
	OPC	6,620	3,000	20,405	30,200	0	60,225
	TPC	141,892	3,000	20,405	30,200	0	195,497
FY 2023	TEC	135,272	0	20,000	58,356	0	213,628
	OPC	6,620	0	0	5,787	1,965	14,372
	TPC	141,892	0	20,000	64,143	1,965	228,000

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	1Q FY 2028
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	1Q FY 2078

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	15.14	15.14	757	757

7. D&D Information

The disposition of the existing facilities has been captured in NNSA's infrastructure planning system and will be funded outside of the line-item once HESE is operational.

	Square Feet
New area being constructed by this project at Pantex Plant	72,500
Area of D&D at the Pantex Plant	0[a]
Area at the Pantex Plant to be transferred, sold, and/or D&D outside the project including area previously "banked"	72,500
Area of D&D in this project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the project including area previously "banked"	0
Total area eliminated	72,500[a]

Pantex Plant Zone 11, Bldgs 11-2, 11-5, 11-14, 11-16, 11-17, 11-17A, 11-18, 11-19, 11-22, 11-27, 11-28, 11-38, 11-45, 11-47, 11-R-4, 11-R-7, 11-R-8, 11-R-10, 11-R-11, 11-R-13, 11-R-13A, and 11-R-23.

8. Acquisition Approach

The design and the construction were acquired through firm-fixed price contracts under the existing M&O cost plus incentive fee contract.

[a] Changed from the FY 2021 CPDS that indicated 82,766 SF because the D&D has been removed from the project.

21-D-512, Los Alamos Plutonium Pit Production Project (LAP4)
Los Alamos National Laboratory (LANL)
Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary:

The Fiscal Year (FY) 2023 request for the Los Alamos Plutonium Pit Production Project (LAP4) is $588,234K of Total Project Costs (TPC). Estimated outyear funding amounts may be revised in future budget requests as National Nuclear Security Administration (NNSA) baselines the subprojects in accordance with Department of Energy (DOE) Order (O) 413.3B. The FY 2023 request includes funds to continue design activities on the four subprojects that have not received CD-2/3 approval and to continue construction activities in the D&D subproject.

LAP4 includes the procurement of equipment and systems to support a baseline production increase from 10 plutonium pits per year (ppy) at LANL to not less than 30 ppy, and to provide equipment and infrastructure necessary to support the reliable and timely provision of strategic weapons systems' primary components to strategic defense missions.

Critical Decision (CD)-1, *Approve Alternative Selection and Cost Range*, was approved April 27, 2021, with a TPC cost range of $2,700,000K - $3,900,000K. The full project TPC will not be determined until all the subprojects are baselined at CD-2/3 approval, but it includes both Total Estimated Cost (TEC) and Other Project Cost (OPC) that will be executed through this line item funding.

The project is supported by the Plutonium Pit Production Analysis of Alternatives (AoA), completed in October 2017, and the Plutonium Pit Production Engineering Assessment (EA), completed in April 2018.

Per DOE O 413.3B, any cost savings realized from an LAP4 subproject will be returned to the LAP4 Total Project contingency pool for use, as needed after approval of a baseline change, in other LAP4 subprojects within this CPDS.

Significant Changes:

This Construction Project Data Sheet (CPDS) is an update of the FY 2022 CPDS and does not include a new start for the budget year. This data sheet updates the project to include, a) establishing a performance baseline for the Decontamination and Decommissioning (D&D) subproject, b) approval of long-lead equipment and enclosure procurements for the 30 ppy Base Equipment Installation subproject, and c) updates to acquisition/tailoring to the remainder of the LAP4 subprojects that are currently under review. The overall CD-2/3 date for the LAP4 project has been delayed by about 18 months due to a re-prioritization of the subprojects, which has resulted in the 30 Reliable and the Training and Development Center being delayed.

The project is not currently funded at the high-end range of the approved CD-1 estimate. NNSA will continue value engineering efforts to reduce the total cost of the project and revise outyear amounts as design matures. The project will continue to refine the tailoring strategy to reflect program priorities, funding, resource availability, and other criteria, as is indicated in the changes in values between this submission and the one in FY 2022. These changes are reflected in Critical Milestone History and represent the current planning basis of the project. These changes are currently under review by NNSA. Until design is complete, and the performance baselines are established for each subproject, the finalization of the required funding profiles and completion dates cannot be established. Outyear funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE O 413.3B.

Specific details on the changes to the LAP4 subprojects are listed below.

D&D Subproject (21-D-512-01): Achieved CD-2/3, *Approve Performance Baseline* and *Approve Start of Construction* on November 18, 2021, with a TPC of $529,000,000 and a schedule completion date of March 2027.

30 Base (30B) Subproject (21-D-512-02): Achieved CD-3A, *Approve Long-Lead Procurements* on January 3, 2022, with a TPC of $71,939,000 and a completion date of June 2024. The 30B subproject anticipates reaching final design completion, establishing a performance baseline (CD-2), and approving start of construction (CD-3) in December 2022.

30 Reliable (30R) Subproject (21-D-512-03): The 30R subproject, currently at CD-1, anticipates completing a CD-3A long-lead procurement package in December 2022. Final design completion, establishing a performance baseline (CD-2), and approving start of construction (CD-3) is anticipated in December 2023. The changes in the schedule reflect the focusing of resources and funding on 30B and near-term priorities consistent with updated acquisition and tailoring strategies that are under evaluation by NNSA. The long-lead procurement activities are intended to mitigate the delays associated delays with achieving CD-2/3 as originally planned at CD-1.

Training and Development Center (TDC) Subproject (21-D-512-04): Currently at CD-1, the TDC subproject anticipates final design completion, establishing a performance baseline (CD-2), and approving start of construction (CD-3) in September 2024. The changes in the schedule reflect the focusing of resources and funding on 30B, WECF, and near-term priorities consistent with updated acquisition and tailoring strategies that are under evaluation.

West Entry Control Facility (WECF) Subproject (21-D-512-05): Currently at CD-1, the WECF subproject anticipates final design completion, establishing a performance baseline (CD-2), and approving start of construction (CD-3) in March 2023.

A Federal Project Director has been assigned to the project.

Critical Milestone History

Los Alamos Plutonium Pit Production Project (21-D-512)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	11/25/2015	4Q FY2020	1Q FY2021	4Q FY2022	4Q FY2022	4Q FY2022	2Q FY2024	4Q FY2028
FY 2022	11/25/2015	4Q FY2020	04/27/2021	2Q FY2023	1Q FY2023	2Q FY2023	N/A	4Q FY2028
FY 2023	11/25/2015	03/08/2021	04/27/2021	4Q FY2024	3Q FY2024	4Q FY2024	N/A	4Q FY2028

Decontamination and Decommissioning (D&D) Subproject (21-D-512-01)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	CD-4
FY 2023	11/25/2015	03/08/2021	04/27/2021	10/28/2021	2QFY2022	10/28/2021	2Q FY2027

30 Base Equipment Installation (30B) Subproject (21-D-512-02)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	CD-4
FY 2023	11/25/2015	03/08/2021	04/27/2021	1Q FY2023	4Q FY2022	1Q FY2023	4Q FY2026

Fiscal Year	CD-3A
FY 2022	2Q FY 2022
FY 2023	01/03/2022

CD-3A – Approve Long-Lead Procurements

30 Reliable Equipment Installation (30R) Subproject (21-D-512-03)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	CD-4
FY 2023	11/25/2015	03/08/2021	04/27/2021	1Q FY2024	4Q FY2023	1Q FY2024	4Q FY2028

Fiscal Year	CD-3A
FY 2023	1Q FY2023

CD-3A – Approve Long-Lead Procurements

Training and Development Center Subproject (TDC) (21-D-512-04)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	CD-4
FY 2023	11/25/2015	03/08/2021	04/27/2021	4Q FY2024	3Q FY2024	4Q FY2024	4Q FY2028

West Entry Control Facility (WECF) Subproject (21-D-512-05)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	CD-4
FY 2023	11/25/2015	03/08/2021	04/27/2021	2Q FY2023	4Q FY2022	2Q FY2023	2Q FY2026

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History

Los Alamos Plutonium Pit Production Project (21-D-512)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC	OPC, Total	TPC
FY 2021	116,900	79,100	196,000	30,000	30,000	226,000[a]
FY 2022	456,000	3,035,000	3,491,000	404,000	404,000	3,895,000[b]
FY 2023	489,897	3,005,340	3,495,237	399,763	399,763	3,895,000[b]

D&D Subproject (21-D-512-01)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC	OPC, Total	TPC
FY 2023	22,689	459,695	482,384	46,616	46,616	529,000[c]

30B Subproject (21-D-512-02)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC	OPC, Total	TPC
FY 2023	212,626	1,599,990	1,812,616	213,384	213,384	2,026,000

30R Subproject (21-D-512-03)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC	OPC, Total	TPC
FY 2023	163,074	517,871	680,945	79,055	79,055	760,000

TDC Subproject (21-D-512-04)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC	OPC, Total	TPC
FY 2023	71,185	331,947	403,132	46,868	46,868	450,000

WECF Subproject (21-D-512-05)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC	OPC, Total	TPC
FY 2023	20,323	95,837	116,160	13,840	13,840	130,000

2. Project Scope and Justification

Scope

The project scope includes the further repurposing of spaces within the existing LANL Plutonium Facility 4 (PF-4), beyond the scope of repurposing in the Chemistry and Metallurgy Research Replacement (CMRR) project, including removal of previously installed equipment and support systems as necessary to accommodate new pit production equipment. Scope

[a] The project cost history amounts for FY 2021 reflected only funding requested in that budget year; TPC is not indicative of the total project cost.

[b] The TPC reflects the top of the CD-1 cost range.

[c] The D&D subproject established a performance baseline on October 28, 2021.

includes design, construction, and installation of processing equipment, support systems, utilities infrastructure, physical infrastructure, and security features to reach the capability to produce 30 ppy. The PF-4 is an operating Hazard Category (HC)- 2, Security Category 1 Nuclear Facility. PF-4 and supporting capabilities need to be modified to achieve the required pit production capability/capacity.

The LAP4 project is composed of the five subprojects identified below.

Decontamination and Decommissioning (D&D) Subproject (21-D-512-01)

Decontamination and decommissioning of enclosures and programmatic equipment in PF-4 in preparation for installation of pit production equipment. The scope encompasses characterization, D&D, size reduction, removal, waste handling, and disposition.

30 Base Equipment Installation (30B) Subproject (21-D-512-02)

Pit production enclosures and programmatic equipment procurement and installation to support pit production capacity of a base of 30 ppy. The scope encompasses designing, procuring, installing, testing, transitioning to operations (TTO), and hot startup of new gloveboxes and associated equipment in PF-4 and the Sigma facility. The 30B subproject establishes a capability and capacity to provide a minimum of 30 war reserve ppy to the stockpile. To support reduced project and program risk, long-lead procurement and fabrication of enclosures and process equipment was approved on December 21, 2021, and is expected to be complete in 2023. Advanced procurement of the long-lead equipment integrates with the anticipated approval of CD-2/3 in December of 2022, enabling installation to proceed immediately after the approval of the performance baseline. Installation of the long-lead procurement will proceed as the remainder of the 30B enclosures and equipment are fabricated. This tailored approach minimizes impacts to program operations and increase construction efficiencies. Additionally, temporary 80,000 sq ft warehouse space will be provided for the pre-staging of equipment for setup, testing, and assembly, prior to final installation.

30 Reliable Equipment Installation (30R) Subproject (21-D-512-03)

Pit production enclosures and programmatic equipment procurement and installation to support pit production capacity of 30 ppy reliably. The scope encompasses designing, procuring, installing, testing, transitioning to operations (TTO), and hot startup of new gloveboxes and associated equipment in PF-4 and the Sigma facility. The 30R subproject expands the capability and capacity to provide 30 war reserve pits per year to the stockpile at a 90% confidence using a single shift. To support reduced project and program risk, long-lead procurement and fabrication of enclosures and process equipment is planned for December 2022 and is expected to be complete in FY 2024. Advanced procurement of the long-lead equipment integrates with the anticipated approval of CD-2/3 in December of 2023, enabling installation to proceed immediately after the approval of the performance baseline. Installation of the long-lead procurement will proceed as the remainder of the 30R enclosures and equipment are fabricated. This tailored approach minimizes impacts to program operations and increase construction efficiencies.

Training and Development Center (TDC) Subproject (21-D-512-04)

The Training capability will ensure that production personnel can effectively receive approximately 700,000 required annual staff training hours for initial and annual training, including certification to fully satisfy skill and qualification requirements. The Development capability will support the enduring pit production mission by providing facilities and space for process improvement and development in a non-nuclear environment. The two capabilities require 75,000 net square feet and are briefly summarized below:

- Nuclear worker training laboratories for glovebox operator and fissile material handler fundamentals training and process worker requalification training. The requalification training laboratories will have a dual purpose to also support production process and technology development activities.
- Unclassified Training areas including classrooms, computer-based training rooms, a training records management center and training staff office space.
- Classified Training areas including classrooms, conference rooms, auditorium/lecture hall, classified records management and storage, facility control system simulation area, cold machine shop, a glovebox equipment pre-installation testing area, and a classified parts vault-type room.

West Entry Control Facility (WECF) Subproject (21-D-512-05)

The TA-55 WECF is required to accommodate the additional 800 workers per day entering the property protection area at TA-55 projected to implement the 30 ppy mission. This projected increase effectively doubles the workforce entrance control processing demand. The new WECF, like the existing East ECF, must be a DOE-compliant personnel screening facility which maintains integrity of the protected area at TA-55 to enable safe and secure environment for manufacturing operations and support the required 24/7 schedule.

Justification

The NNSA's ability to produce pits in the required quantities established by the Nuclear Weapons Council (NWC) is an essential component of the nuclear deterrent. An Analysis of Alternatives (AoA) was conducted after CD-0, in accordance with the requirements of Office of Management and Budget (OMB) Circular A-11. The AoA identified two preferred alternatives with different construction approaches at two separate locations:

- Additional capability and capacity to accomplish 30 ppy pit production requirements at Los Alamos National Laboratory (LANL); and,
- Refurbishment and repurposing of facilities at the Savannah River Site to accomplish the capability and capacity to reach an additional 50 ppy.

Sustained and reliable pit production at LANL additionally requires a commensurate increase in infrastructure and support facilities to accommodate the increased activity in a nuclear facility with a diversified mission portfolio. Resources necessary to operate and maintain a sustained and substantial production capacity drives a critical need for training infrastructure, which is included in this project. Increased ingress and egress of production personnel is also essential, and this project includes a new personnel access point/facility into Technical Area-55, which encloses the plutonium facilities. Other infrastructure upgrades necessary to support pit production goals have been identified, and will be acquired by other means, and are not included in the LAP4 project.

The NNSA Office of Cost Estimating and Program Evaluation conducted a review of the AoA and recommended that further refinement of the preferred alternatives be completed before selecting an alternative that meets requirements. NNSA contracted with an independent architecture and engineering (A&E) firm to complete an Engineering Assessment of the two preferred alternatives and two additional alternatives to provide the basis for a future decision.

The Chairwoman of the NWC provided written certification to Congress regarding the NNSA's recommended alternative on May 4, 2018. The NNSA Administrator selected a preferred alternative on May 10, 2018, to continue pit production investments to reach the 30 ppy capability at LANL by 2026, and to repurpose facilities at the Savannah River Site to produce 50 plutonium pits per year.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets.* Funds appropriated under the Plutonium Modernization Program and described in this data sheet may be used for contracted support services to the Federal Project Director and to conduct independent reviews of design and construction for LAP4.

Preliminary Key Performance Parameters (KPPs)

The KPPs represent the minimum acceptable performance that the project must achieve. Preliminary Key Performance Parameters were developed as part of the CD-1 approval and will be finalized for CD-2 approval.

Preliminary Key Performance Measures
D&D: Complete turnover, to facility operations, of the space and infrastructure of D&D items in PF-4 identified in the LAP4 Program Requirement Document (PRD), Appendix B.
D&D: Complete disposition and removal of decommissioned, demolished, and removed equipment waste from TA-55 under LAP4.
30B: Complete equipment hot testing and turnover of 11 – 30 ppy base equipment and structures, systems, and components necessary to achieve a 30 ppy base capacity in PF-4 and Sigma, identified in the LAP4 PRD, Appendix B, to Weapons Production for initiation of Process Prove-in activities.
30R: Complete equipment hot testing and turnover of all 30 ppy reliable equipment and structures, systems, and components identified in the LAP4 PRD, Appendix B, to Weapons Production for initiation of Process Prove-in activities.
LAP4 Infrastructure: Training and Development Center, and TA-55 West Entry Control Facility will receive beneficial occupancy to allow operations.

3. Financial Schedule

The TPC in this section does not reflect the top of the CD-1 cost range.

Los Alamos Plutonium Pit Production Project (21-D-512)

(Dollars in Thousands)

		Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)				
	Design			
	FY 2021	154,000[a]	154,000	21,015
	FY 2022	148,300	148,300	225,756
	FY 2023	120,268	120,268	175,258
	FY 2024	55,000	55,000	49,971
	FY 2025	12,329	12,329	17,897
	Total Design	**489,897**	**489,897**	**489,897**
	Construction			
	FY 2021	72,000[a]	72,000	5,167
	FY 2022	196,700	196,700	102,146
	FY 2023	426,966	426,966	397,902
	FY 2024	562,000	562,000	725,374
	FY 2025	580,831	580,831	605,935
	FY 2026	563,515	563,515	524,846
	FY 2027	305,000	305,000	343,998
	FY 2028	12,300	12,300	13,944
	Total Construction	**2,719,312**	**2,719,312**	**2,719,312**

[a] This value does not equal the amount from the FY 2022 submission as the funding spread was changed as the CD-1 package was finalized.

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Costs (TEC)			
FY 2021	226,000	226,000	26,182
FY 2022	345,000	345,000	327,902
FY 2023	547,234	547,234	573,160
FY 2024	617,000	617,000	775,345
FY 2025	593,160	593,160	623,832
FY 2026	563,515	563,515	524,846
FY 2027	305,000	305,000	343,998
FY 2028	12,300	12,300	13,944
Total TEC	**3,209,209**	**3,209,209**	**3,209,209**
Other Project Costs (OPC)			
FY 2019	1,932	1,932	1,930
FY 2020	58,068[a]	58,068	24,950
FY 2021	0	0	28,241
FY 2022	5,000	5,000	6,900
FY 2023	41,000	41,000	41,000
FY 2024	53,000	53,000	42,000
FY 2025	66,840	66,840	58,600
FY 2026	61,485	61,485	59,514
FY 2027	60,000	60,000	81,904
FY 2028	42,000	42,000	44,286
Total OPC	**389,325**	**389,325**	**389,325**
Total Project Costs (TPC)			
FY 2019	1,932	1,932	1,930
FY 2020	58,068	58,068	24,950
FY 2021	226,000	226,000	54,423
FY 2022	350,000	350,000	334,802
FY 2023	588,234	588,234	614,160
FY 2024	670,000	670,000	817,345
FY 2025	660,000	660,000	682,432
FY 2026	625,000	625,000	584,360
FY 2027	365,000	365,000	425,902
FY 2028	54,300	54,300	58,230
Grand Total	**3,598,534**	**3,598,534**	**3,598,534**[b]

[a] This value does not equal the amount from the FY22 submission because after the submission, a better understanding of the amount of OPC that was provided in FY20 between the project and program was understood.

[b] The total project cost in section 3 does not equal the total project cost in sections 2 and 4 due to ongoing efforts to reduce the cost of the project through value engineering, as well as a broader effort to balance risk across the Production Modernization portfolio.

Decontamination and Decommissioning (D&D) Subproject (21-D-512-01)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	22,689	22,689	15,504
FY 2022	0	0	7,185
Total Design	**22,689**	**22,689**	**22,689**
Construction			
FY 2021	72,000	72,000	5,167
FY 2022	74,700	74,700	69,146
FY 2023	119,000	119,000	125,260
FY 2024	92,000	92,000	140,641
FY 2025	58,840	58,840	58,968
FY 2026	23,209	23,209	39,000
FY 2027	20,000	20,000	21,567
Total Construction	**459,749**	**459,749**	**459,749**
Total Estimated Costs (TEC)			
FY 2021	94,689	94,689	20,671
FY 2022	74,700	74,700	76,331
FY 2023	119,000	119,000	125,260
FY 2024	92,000	92,000	140,641
FY 2025	58,840	58,840	58,968
FY 2026	23,209	23,209	39,000
FY 2027	20,000	20,000	21,567
Total TEC	**482,438**	**482,438**	**482,438**
Other Project Costs (OPC)			
FY 2019	302	302	300
FY 2020	9,289	9,289	3,875
FY 2021	0	0	4,387
FY 2022	1,000	1,000	1,000
FY 2023	2,000	2,000	2,000
FY 2024	6,000	6,000	5,000
FY 2025	15,000	15,000	8,000
FY 2026	12,971	12,971	12,000
FY 2027	0	0	10,000
Total OPC	**46,562**	**46,562**	**46,562**

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TPC)			
FY 2019	302	302	300
FY 2020	9,289	9,289	3,875
FY 2021	94,689	94,689	25,058
FY 2022	75,700	75,700	77,331
FY 2023	121,000	121,000	127,260
FY 2024	98,000	98,000	145,641
FY 2025	73,840	73,840	66,968
FY 2026	36,180	36,180	51,000
FY 2027	20,000	20,000	31,567
Grand Total	**529,000**	**529,000**	**529,000**

30 Base Equipment Installation (30B) Subproject (21-D-512-02)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	130,311	130,311	5,511
FY 2022	78,000	78,000	164,000
FY 2023	4,315	4,315	43,115
Total Design	**212,626**	**212,626**	**212,626**
Construction			
FY 2022	122,000	122,000	33,000
FY 2023	223,000	223,000	223,000
FY 2024	367,603	367,603	450,000
FY 2025	429,000	429,000	409,000
FY 2026	206,628	206,628	229,231
FY2027	56,000	56,000	60,000
Total Construction	**1,404,231**	**1,404,231**	**1,404,231**

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Costs (TEC)			
FY 2021	130,311	130,311	5,511
FY 2022	200,000	200,000	197,000
FY 2023	227,315	227,315	266,115
FY 2024	367,603	367,603	450,000
FY 2025	429,000	429,000	409,000
FY 2026	206,628	206,628	229,231
FY 2027	56,000	56,000	60,000
Total TEC	**1,616,857**	**1,616,857**	**1,616,857**
Other Project Costs (OPC)			
FY 2019	966	966	966
FY 2020	26,634	26,634	12,492
FY 2021	0	0	14,138
FY 2022	4,000	4,000	3,500
FY 2023	39,000	39,000	39,000
FY 2024	47,000	47,000	37,000
FY 2025	41,400	41,400	40,000
FY 2026	43,000	43,000	42,000
FY2027	0	0	12,904
Total OPC	**202,000**	**202,000**	**202,000**
Total Project Costs (TPC)			
FY 2019	966	966	966
FY 2020	26,634	26,634	12,492
FY 2021	130,311	130,311	19,649
FY 2022	204,000	204,000	200,500
FY 2023	266,315	266,315	305,115
FY 2024	414,603	414,603	487,000
FY 2025	470,400	470,400	449,000
FY 2026	249,628	249,628	271,231
FY 2027	56,000	56,000	72,904
Grand Total	**1,818,857**	**1,818,857**	**1,818,857**

30 Reliable Equipment Installation (30R) Subproject (21-D-512-03)

(Dollars in Thousands)

		Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)				
	Design			
	FY 2022	53,300	53,300	37,000
	FY 2023	87,674	87,674	103,000
	FY 2024	22,100	22,100	23,074
	Total Design	**163,074**	**163,074**	**163,074**
	Construction			
	FY 2023	43,289	43,289	15,000
	FY 2024	57,000	57,000	95,000
	FY 2025	81,160	81,160	115,000
	FY 2026	233,626	233,626	155,000
	FY 2027	51,569	51,569	85,000
	FY 2028	0	0	1,644
	Total Construction	**466,644**	**466,644**	**466,644**
	Total Estimated Costs (TEC)			
	FY 2022	53,300	53,300	37,000
	FY 2023	130,963	130,963	118,000
	FY 2024	79,100	79,100	118,074
	FY 2025	81,160	81,160	115,000
	FY 2026	233,626	233,626	155,000
	FY 2027	51,569	51,569	85,000
	FY 2028	0	0	1,644
	Total TEC	**629,718**	**629,718**	**629,718**
Other Project Costs (OPC)				
	FY 2019	377	377	377
	FY 2020	11,623	11,623	4,868
	FY 2021	0	0	5,510
	FY 2022	0	0	0
	FY 2023	0	0	0
	FY 2024	0	0	0
	FY 2025	0	0	0
	FY 2026	4,055	4,055	4,055
	FY 2027	43,000	43,000	43,000
	FY 2028	20,000	20,000	21,245
	Total OPC	**79,055**	**79,055**	**79,055**

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Costs (TPC)			
FY 2019	377	377	377
FY 2020	11,623	11,623	4,868
FY 2021	0	0	5,510
FY 2022	53,300	53,300	37,000
FY 2023	130,963	130,963	118,000
FY 2024	79,100	79,100	118,074
FY 2025	81,160	81,160	115,000
FY 2026	237,681	237,681	159,055
FY 2027	94,569	94,569	128,000
FY 2028	20,000	20,000	22,889
Grand Total	**708,773**	**708,773**	**708,773**

Training and Development Center (TDC) Subproject (21-D-512-04)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2022	3,100	3,100	3,039
FY 2023	22,856	22,856	22,816
FY 2024	32,900	32,900	27,433
FY 2025	12,329	12,329	17,897
Total Design	**71,185**	**71,185**	**71,185**
Construction			
FY 2024			
FY 2025	11,831	11,831	11,831
FY 2026	100,052	100,052	100,052
FY 2027	177,431	177,431	177,431
FY 2028	12,300	12,300	12,300
Total Construction	**301,614**	**301,614**	**301,614**
Total Estimated Costs (TEC)			
FY 2022	3,100	3,100	3,039
FY 2023	22,856	22,856	22,816
FY 2024	32,900	32,900	27,433
FY 2025	24,160	24,160	29,728
FY 2026	100,052	100,052	100,052

	Budget Authority (Appropriations)	Obligations	Costs
FY 2027	177,431	177,431	177,431
FY 2028	12,300	12,300	12,300
Total TEC	**372,799**	**372,799**	**372,799**
Other Project Costs (OPC)			
FY 2019	223	223	223
FY 2020	7,186	7,186	2,882
FY 2021	0	0	3,263
FY 2022	0	0	1,000
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	0	0	0
FY 2026	1,459	1,459	1,459
FY 2027	17,000	17,000	16,000
FY 2028	22,000	22,000	23,041
Total OPC	**47,868**	**47,868**	**47,868**
Total Project Costs (TPC)			
FY 2019	223	223	223
FY 2020	7,186	7,186	2,882
FY 2021	0	0	3,263
FY 2022	3,100	3,100	4,039
FY 2023	22,856	22,856	22,816
FY 2024	32,900	32,900	27,433
FY 2025	24,160	24,160	29,728
FY 2026	101,511	101,511	101,511
FY 2027	193,431	193,431	193,431
FY 2028	34,300	34,300	34,341
Grand Total	**420,667**	**420,667**	**420,667**

West Entry Control Facility (WECF) Subproject (21-D-512-05)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	1,000	1,000	0
FY 2022	13,900	13,900	14,532
FY 2023	5,423	5,423	5,791
Total Design	**20,323**	**20,323**	**20,323**

	Budget Authority (Appropriations)	Obligations	Costs
Construction			
FY 2023	41,677	41,677	34,642
FY 2024	45,397	45,397	39,733
FY 2025	0	0	11,136
FY 2026	0	0	1,563
Total Construction	**87,074**	**87,074**	**87,074**
Total Estimated Costs (TEC)			
FY 2021	1,000	1,000	0
FY 2022	13,900	13,900	14,532
FY 2023	47,100	47,100	40,433
FY 2024	45,397	45,397	39,733
FY 2025	0	0	11,136
FY 2026	0	0	1,563
Total TEC	**107,397**	**107,397**	**107,397**
Other Project Costs (OPC)			
FY 2019	64	64	64
FY 2020	3,336	3,336	833
FY 2021	0	0	943
FY 2022	0	0	1,400
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	10,440	10,440	10,600
FY 2026	0	0	0
Total OPC	**13,840**	**13,840**	**13,840**
Total Project Costs (TPC)			
FY 2019	64	64	64
FY 2020	3,336	3,336	833
FY 2021	1,000	1,000	943
FY 2022	13,900	13,900	15,932
FY 2023	47,100	47,100	40,433
FY 2024	45,397	45,397	39,733
FY 2025	10,440	10,440	21,736
FY 2026	0	0	1,563
Grand Total	**121,237**	**121,237**	**121,237**

4. **Details of Project Cost Estimate**

Overall Project (21-D-512)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	371,468	365,000	N/A
Federal Design Support	20,585	37,000	N/A
Contingency	97,844	54,000	N/A
Total Design	489,897	456,000	N/A
Construction			
Site Preparation	85,400	300,000	N/A
Equipment	190,738	154,000	N/A
Construction	1,788,323	2,100,000	N/A
Federal Construction Support	58,067	75,000	N/A
Contingency	882,812	406,000	N/A
Total Construction	3,005,340	3,035,000	N/A
Total Estimated Cost	**3,495,237**	**3,491,000**	**N/A**
Contingency, TEC	*980,656*	*460,000*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Activities	58,379	59,000	N/A
Start-up	257,900	294,000	N/A
Contingency	83,484	51,000	N/A
Total, OPC	399,763	404,000	N/A
Contingency, OPC	*83,484*	*51,000*	*N/A*
Total Project Cost	**3,895,000**	**3,895,000**	**N/A**
Total Contingency (TEC+OPC)	***1,064,140***	***511,000***	***N/A***

Decontamination and Decommissioning (D&D) Subproject (21-D-512-01)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	22,689	N/A	22,689
Federal Design Support	0	N/A	0
Contingency	0	N/A	0
Total Design	22,689	N/A	22,689
Construction			
Site Preparation	0	N/A	0
Equipment	46,238	N/A	46,238
Construction	258,244	N/A	258,244
Federal Construction Support	11,946	N/A	11,946
Contingency	143,267	N/A	143,267
Total Construction	459,695	N/A	459,695
Total Estimated Cost	**482,384**	**N/A**	**482,384**
Contingency, TEC	*145,267*	*N/A*	*145,267*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Activities	8,616	N/A	8,616
Start-up	36,000	N/A	36,000
Contingency	2,000	N/A	2,000
Total, OPC	46,616	N/A	46,616
Contingency, OPC	*2,000*	*N/A*	*2,000*
Total Project Cost	**529,000**	**N/A**	**529,000**
Total Contingency (TEC+OPC)	***145,267***	***N/A***	***145,267***

30 Base Equipment Installation (30B) Subproject (21-D-512-02)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	161,186	N/A	N/A
Federal Design Support	10,973	N/A	N/A
Contingency	40,467	N/A	N/A
Total Design	212,626	N/A	N/A
Construction			
Site Preparation	46,000	N/A	N/A
Equipment	60,000	N/A	N/A
Construction	983,373	N/A	N/A
Federal Construction Support	28,853	N/A	N/A
Contingency	481,764	N/A	N/A
Total Construction	1,599,990	N/A	N/A
Total Estimated Cost	**1,812,616**	**N/A**	**N/A**
Contingency, TEC	*522,231*	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Activities	30,800	N/A	N/A
Start-up	131,200	N/A	N/A
Contingency	51,384	N/A	N/A
Total, OPC	213,384	N/A	N/A
Contingency, OPC	51,384	*N/A*	*N/A*
Total Project Cost	**2,026,000**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***573,615***	***N/A***	***N/A***

30 Reliable Equipment Installation (30R) Subproject (21-D-512-03)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	120,670	N/A	N/A
Federal Design Support	4,804	N/A	N/A
Contingency	37,600	N/A	N/A
Total Design	163,074	N/A	N/A
Construction			
Site Preparation	0	N/A	N/A
Equipment	40,000	N/A	N/A
Construction	323,602	N/A	N/A
Federal Construction Support	9,128	N/A	N/A
Contingency	145,141	N/A	N/A
Total Construction	517,871	N/A	N/A
Total Estimated Cost	**680,945**	**N/A**	**N/A**
Contingency, TEC	*182,741*	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Activities	10,755	N/A	N/A
Start-up	51,300	N/A	N/A
Contingency	17,000	N/A	N/A
Total, OPC	79,055	N/A	N/A
Contingency, OPC	17,000	*N/A*	*N/A*
Total Project Cost	**760,000**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***199,741***	***N/A***	***N/A***

Training and Development Center (TDC) Subproject (21-D-512-04)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	51,923	N/A	N/A
Federal Design Support	3,885	N/A	N/A
Contingency	15,377	N/A	N/A
Total Design	71,185	N/A	N/A
Construction			
Site Preparation	30,600	N/A	N/A
Equipment	40,000	N/A	N/A
Construction	167,606	N/A	N/A
Federal Construction Support	6,475	N/A	N/A
Contingency	87,266	N/A	N/A
Total Construction	331,947	N/A	N/A
Total Estimated Cost	**403,132**	**N/A**	**N/A**
Contingency, TEC	102,643	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Activities	6,368	N/A	N/A
Start-up	30,500	N/A	N/A
Contingency	10,000	N/A	N/A
Total, OPC	46,868	N/A	N/A
Contingency, OPC	10,000	*N/A*	*N/A*
Total Project Cost	**450,000**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***112,643***	***N/A***	***N/A***

West Entry Control Facility (WECF) Subproject (21-D-512-05)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	15,000	N/A	N/A
Federal Design Support	923	N/A	N/A
Contingency	4,400	N/A	N/A
Total Design	20,323	N/A	N/A
Construction			
Site Preparation	8,800	N/A	N/A
Equipment	4,500	N/A	N/A
Construction	55,498	N/A	N/A
Federal Construction Support	1,665	N/A	N/A
Contingency	25,374	N/A	N/A
Total Construction	95,837	N/A	N/A
Total Estimated Cost	**116,160**	**N/A**	**N/A**
Contingency, TEC	*29,774*	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Activities	1,840	N/A	N/A
Start-up	8,900	N/A	N/A
Contingency	3,100	N/A	N/A
Total, OPC	13,840	N/A	N/A
Contingency, OPC	3,100	*N/A*	*N/A*
Total Project Cost	**130,000**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***32,874***	***N/A***	***N/A***

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Outyears	Total
FY 2020	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	26,156	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	26,156
FY 2021	TEC	N/A	196,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	30,000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	26,156	226,000	350,000	500,000	450,000	200,000	200,000	N/A	N/A	TBD
FY 2022	TEC	0	196,000	310,000	N/A	N/A	N/A	N/A	N/A	2,985,000	3,491,000
	OPC	60,000	30,000	40,000	N/A	N/A	N/A	N/A	N/A	274,000	404,000
	TPC	60,000	226,000	350,000	TBD	TBD	TBD	TBD	N/A	3,259,000	3,895,000
FY 2023	TEC	0	226,000	345,000	547,234	617,000	593,160	563,515	305,000	12,300	3,209,209
	OPC	60,000	0	5,000	41,000	53,000	66,840	61,485	60,000	42,000	389,325
	TPC	60,000	226,000	350,000	588,234	670,000	660,000	625,000	365,000	54,300	3,598,534

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2028
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	4Q FY 2078

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs[a]	
	Previous Total Estimate	**Current Total Estimate**	**Previous Total Estimate**	**Current Total Estimate**
Operations and Maintenance	$88	$88	$9,800	$9,800

7. D&D Information

The scope parameters established at CD-1 established the necessary site infrastructure improvements (West Entry Control Facility, Training and Development Center, temporary warehouse, material staging and laydown area, etc.) to support establishing a 30 ppy mission and to enable increased construction capacity, risk mitigation, and project efficiency.

These activities will include an increase in site square footage and the D&D of equipment within existing facilities. The D&D of existing facilities are not funded on this project. PF-4 D&D is not part of the LAP4 project scope. Some removal of contaminated equipment in PF-4 for space reuse will occur using project funds.

[a] Life cycle costs associated with this project were developed as part of CD-1. Neither the Plutonium Pit Production Analysis of Alternatives (AoA) nor Plutonium Pit Production Engineering Assessment (EA) evaluated life cycle costs of reaching 30 ppy at LANL separately from reaching the full 80 ppy production rate for various LANL options.

Gross Square Footage Created/Eliminated	WECF Square Feet	TDC Square Feet	Temporary Warehouse Square Feet
New area to be constructed by this project at Los Alamos National Laboratory……………………………………………………………………….	32,000	130,000	80,000
Area of D&D in this project at Los Alamos National Laboratory	0	0	0
Area at Los Alamos National Laboratory to be transferred, sold, and/or D&D outside the project including area previously "banked"………………………………………………………………………………………………	32,000	130,000	80,000
Area of D&D in this project at other sites	0	0	0
Area at other sites to be transferred, sold, and/or D&D outside the project including area previously "banked	0	0	0
Total area eliminated …………………………………………………………………………..	0	0	0

8. Acquisition Approach

Expansion of pit production capacity at LANL will be accomplished with the installation of systems of gloveboxes and equipment. Equipment installation to provide the capability to produce 10 ppy will be accomplished using program funding in the Plutonium Modernization Program. The installation of equipment to produce more than 10 ppy will be accomplished through this project. The LANL management and operating (M&O) contractor will execute design, and construction will be implemented with cleared and accomplished LANL craft resources. Subcontract installation of equipment is not feasible within PF-4, with consideration of concurrent operational activities and the requisite security and safety restraints. The performance baselines for each subproject will be established upon completion of 90% design maturity, to allow development of credible cost estimates in accordance with DOE O 413.3B and NNSA policy.

For infrastructure, non-nuclear design and construction will be executed via M&O-issued design-bid-build and design-build construction contracts. The performance baselines for each subproject will be established using a graded approach for design maturities appropriate for the various facility types, and to allow development of credible cost estimates in accordance with DOE O 413.3B and NNSA policy.

21-D-511, Savannah River Plutonium Processing Facility (SRPPF)
Savannah River Site (SRS), Aiken, South Carolina
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary:
The Fiscal Year (FY) 2023 Request for the Savannah River Plutonium Processing Facility (SRPPF) project is $700,000K of Total Project Costs (TPC). This amount supports meeting the requirement to produce 80 pis per year (ppy) as close to 2030 as possible. Critical Decision (CD)-1 was approved on June 25, 2021 by the Deputy Secretary of Energy. CD-0, Approve Mission Need for the "Plutonium Modular Approach," was approved on November 25, 2015. The approved Mission Need established the requirement for a responsive infrastructure to meet plutonium pit production requirements. This data sheet has been updated to reflect the outcome from approved changes in the project's scope that have occurred since CD-1 approval, which is further described in the Significant Changes section below. The final performance baseline will be established at 90% design completion to support CD-2/3 approval in FY 2024. A Federal Project Director has been assigned to this project and has approved this Construction Project Data Sheet (CPDS).

NNSA completed the Plutonium Pit Production analysis of alternatives (AoA) in October 2017 and the follow-on Plutonium Pit Production Engineering Assessment (EA) in April 2018. Both efforts informed NNSA's selection of a preferred alternative on May 10, 2018 to continue to invest in Los Alamos National Laboratory (LANL) for the capability to produce 30 ppy in 2026, and to repurpose existing facilities at Savannah River Site to produce a capability of 50 ppy in 2030. Based on information developed to support the CD-1 approval, NNSA has determined that achieving the required 50 war reserve ppy production rate at the Savannah River Site in 2030 is not feasible. Establishing the required SRPPF pit production capacity as close as possible to 2030 remains a high-priority and is required for sustaining the effectiveness of the Nation's nuclear deterrent.

The FY 2023 Request includes funds to complete final design and achieve total project CD-2/3 in FY 2024. Funding will continue initial Demolition & Removal (D&R), early long-lead materials and equipment procurements, and approve CD-2/3 to begin construction for the following subprojects to achieve required production capacity closer to 2030:

- Utilities, Site, and Infrastructure Subproject (21-D-511-01)
- Administration Buildings Subproject (21-D-511-03)
- Training and Operations Center Subproject (21-D-511-05)

The scope, cost and schedule estimates approved at CD-1 include an estimated cost range of $6,900,000K to $11,100,000K and a CD-4 schedule range of 1st Quarter FY 2032 to 4th Quarter FY 2035.

Significant Changes:
This CPDS is an update of the FY 2022 CPDS and is not a new start.

The most recent Department of Energy (DOE) approved Critical Decision (CD) for the 21-D-511 project is CD-1. Critical Decision (CD)-1, *Approve Alternative Selection & Cost Range* for the Savannah River Plutonium Processing Facility (SRPPF) Project was approved by the Deputy Secretary of Energy on June 25, 2021.

The FY 2022 SRPPF CPDS included knowledge from two years of detailed planning, benchmarking, and development of the conceptual design and was supported by a 30% design cost and schedule estimate to complete SRPPF. Through this development process, it was determined that NNSA needs to commence initial long-lead equipment procurements and D&R as soon as feasible to have any opportunity to complete the project in the early 2030's. The proposed early activities will cause little to no inherent risk to the on-going SRPPF design but will enable the project to commence construction and enable two major work fronts once design is completed in 4Q FY 2023 and level the work load over the project life cycle. The proposed initial activities will consist of:

1) Long-lead material and equipment procurements - Combined with an intent to maximize the beneficial use of Mixed Oxide Fuel Fabrication Facility (MFFF) material/equipment inventory turned over to SRPPF, to support early construction inside and outside of the process building,
2) Interior to process building - Demolish and remove MFFF paint, commodities, equipment and wall/floor sections,
3) Exterior to the process building - Site preparation for the mobilization of the construction forces and initiation of final below grade excavation, structures and utility installation.

During the NNSA review of the CD-1 package, the decision was made to move to a single line option (SLO) for process operations based on modeling completed for the SRPPF production/through-put. Upon Program Secretarial Officer (PSO) approval, NNSA began to develop a higher-fidelity, more risk-informed design performance baseline, currently scheduled for completion in June 2022. Until the design performance baseline has been completed and approved by NNSA, the Critical Milestone and Project Cost sections of the data sheet are best estimates and updates with further refinement will be included in the FY 2024 submission. The project is in the processes of planning the work to efficiently execute within the funding provided by this data sheet.

The FY 2023 and FY 2024 funding within this request supports preliminary and final design and support for the start of CD-3A early site preparation for the Utilities, Site, and Infrastructure Subproject (21-D-511-01), CD-3A D&R within the 226-F facility associated with the Main Process Buildings Subproject (21-D-511-02), and needed long lead material and equipment procurements, which will maximize beneficial use of the inventory turned over from MFFF materials and equipment. The overall project CD-2/3 approval is still expected prior to the end of FY 2024 and the Critical Milestone and Project Cost sections will be updated at that time.

The SRPPF project will utilize lessons learned in acquisition and execution of similarly-sized nuclear projects, including the execution of the Los Alamos Plutonium Pit Production Project and Uranium Processing Facility Project. These lessons learned include:

- early long-lead material and engineered procurements, including gloveboxes;
- early site preparation, to include D&R required to prepare existing SRS facilities for SRPPF CD-2/3 design and construction activities;and,
- phasing of appropriate SRPPF project work scope into smaller, related, complete and useable sub-projects, where individual “phased” subprojects would be managed under the overall SRPPF CD-1 cost range and schedule range.

The approved CD-1 package identified a multi-subproject construction execution approach. This acquisition approach will continue to be refined as design matures, along with integration with the national supply chain. Within each subproject, where appropriate, a phasing approach will be applied that may include the following as necessary to optimize project schedule and cash flow:

- early site preparation and installation of temporary facilities / utilities necessary to enable construction mobilization, demolition and removal actions, long lead procurements (i.e., CD-3A);
- performance of independent and usable segments of project scope as subprojects utilizing a “phasing” tailoring strategy approach per DOE O 413.3B, (i.e., a phased subproject that would be managed under its own independent CD-2/3 and CD-4. This will be managed under the CD-1 cost and schedule range, prior to the final CD-2/3 and CD-4 for the overall project).

Preliminary Subproject descriptions are included in Section 2. Initial subprojects are:

- Utilities, Site, and Infrastructure Subproject (21-D-511-01)
- Main Process Buildings Subproject (21-D-511-02)
- Administration Buildings Subproject (21-D-511-03)
- Safeguards and Security Subproject (21-D-511-04)
- Training and Operations Center Subproject (21-D-511-05)

NOTE: Site preparations and long-lead procurements will be accomplished via CD-3A under applicable subprojects to optimize project schedule. Prior to initiation of procurements or early site preparation, individual point estimate based performance measurement baselines will be developed, reviewed and approved by the appropriate NNSA approval authority, aligned with the estimated TPC of each CD-3A to establish the basis for performance and resource management.

In FY 2023, project funding for design and construction activities will support continued final design efforts; D&R of equipment and installed commodities in 226-F; long-lead materials and equipment; early preparation and installation for all temporary facilities, utilities (above and below ground) and other general temporary infrastructure necessary to support mobilization and onboarding of construction resources, storage / laydown of construction materials and equipment, shop / fabrication / work areas, etc., to support initiation of SRPPF construction activities; and, final site work including installation of buried process support utilities and a waste transfer line, and demolition and removal of any unneeded MFFF support buildings (temporary and some permanent), and final roadways and grading.

__Critical Milestone History__

Overall Project (21-D-511-01 through 21-D-511-05)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	11/25/2015	4Q FY 2020	2Q FY 2021	TBD	TBD	TBD	N/A	4Q FY 2026 - 4Q FY 2031[a]
FY 2022	11/25/2015	3Q FY 2021	3Q FY 2021	TBD	TBD	TBD	N/A	1Q FY 2032 - 4Q FY2035[b]
FY 2023	11/25/2015	06/25/2021	06/25/2021	1Q FY 2024	4Q FY 2023	1Q FY 2024	N/A	1Q FY 2032 - 4Q FY2035[b]

Utilities, Site, and Infrastructure Subproject (21-D-511-01)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2022	11/25/2015	3Q FY 2021	3Q FY 2021	TBD	TBD	TBD	N/A	TBD
FY 2023	11/25/2015	06/25/2021	6/25/2021	2Q FY 2023	1Q FY 2023	2Q FY 2023	N/A	2Q FY 2030

Main Process Buildings Subproject (21-D-511-02)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2022	11/25/2015	3Q FY2021	3Q FY2021	TBD	TBD	TBD	N/A	TBD
FY 2023	11/25/2015	06/25/2021	6/25/2021	1Q FY 2024	4Q FY 2023	1Q FY 2024	N/A	1Q FY 2032 - 4Q FY 2035[b]

[a] CD-4 range was based on the *Plutonium Pit Production Engineering Assessment.*
[b] CD-4 range reflects the range approved at CD-1.

Administration Buildings Subproject (21-D-511-03)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2022	11/25/2015	3Q FY 2021	3Q FY 2021	TBD	TBD	TBD	N/A	TBD
FY 2023	11/25/2015	06/25/2021	6/25/2021	2Q FY 2023	1Q FY 2023	2Q FY 2023	N/A	4Q FY 2030

Safeguards and Security Subproject (21-D-511-04)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2022	11/25/2015	3Q FY 2021	3Q FY 2021	TBD	TBD	TBD	N/A	TBD
FY 2023	11/25/2015	06/25/2021	6/25/2021	1Q FY 2024	3Q FY 2023	1Q FY 2024	N/A	3Q FY 2029

Training and Operations Center Subproject (21-D-511-05)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2022	11/15/2015	3Q FY 2021	3Q FY 2021	TBD	TBD	TBD	N/A	TBD
FY 2023	11/25/2015	06/25/2021	6/25/2021	2Q FY 2023	1Q FY 2023	2Q FY 2023	N/A	4Q FY 2028

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of Demolition and Disposal (D&D) work
CD-4 – Approve Start of Operations or Project Closeout

Fiscal Quarter or Date

Fiscal Year	D&R CD-3A	Utilities CD-3A
FY 2022	3Q FY 2021	3Q FY 2021
FY 2023	4Q FY 2022	4Q FY 2022

Main Process Building Subproject (21-D-511-02) Demolition and Removal (D&R) CD-3A – Removal of equipment, partially installed commodities, and coatings from Building 226-F.

Utilities, Site, and Infrastructure Subproject (21-D-511-01) CD-3A – Site preparation and installation of all temporary facilities, utilities (above and below ground), other general temporary infrastructure necessary to support mobilization and onboarding of construction resources, i.e., storage / laydown of construction materials and equipment, shop / fabrication / work areas, etc., to support initiation of SRPPF construction activities. Final site work, including installation of buried process support utilities and a waste transfer line, demolition and removal of any unneeded MFFF support buildings (temporary and some permanent), and final roadways/grading.

Project Cost History

Overall Project (21-D-511-01 through 21-D-511-05)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Other	TEC, Total	OPC	OPC, Total	TPC
FY 2021	241,896	0	N/A	241,896	110,000	110,000	4,590,000[a]
FY 2022	TBD	TBD	TBD	TBD	TBD	TBD	11,100,000[b]
FY 2023	1,550,896	6,779,766	589,104	8,919,766	2,180,234	2,180,234	11,100,000[a]

Utilities, Site, and Infrastructure Subproject (21-D-511-01)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Other	TEC, Total	OPC	OPC, Total	TPC
FY 2022	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2023	93,500	406,500	60,000	560,000	60,000	60,000	620,000

Main Process Buildings Subproject (21-D-511-02)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Other	TEC, Total	OPC	OPC, Total	TPC
FY 2022	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2023	1,318,896	5,704,766	441,104	7,464,766	1,935,234	1,935,234	9,400,000

Administration Buildings Subproject (21-D-511-03)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Other	TEC, Total	OPC	OPC, Total	TPC
FY 2022	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2023	5,500	46,500	6,000	58,000	22,000	22,000	80,000

Safeguards and Security Subproject (21-D-511-04)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Other	TEC, Total	OPC	OPC, Total	TPC
FY 2022	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2023	100,000	360,000	60,000	520,000	110,000	110,000	630,000

Training and Operations Center Subproject (21-D-511-05)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Other	TEC, Total	OPC	OPC, Total	TPC
FY 2022	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2023	33,000	262,000	22,000	317,000	53,000	53,000	370,000

[a] TEC and OPC amounts reflect estimated costs for FY 2021 only, the TPC amount reflects the high end of the cost range developed during the *Plutonium Pit Production Engineering Assessment* (EA) in 2018. Future submissions of the project cost history will be updated following CD-1 approval.

[b] TPC amount reflects the high end cost range developed for the CD-1 package.

2. Project Scope and Justification

Scope

The 21-D-511 project scope includes repurposing Building 226-F, including removal of previously installed equipment and support systems as necessary to accommodate the new pit production mission. Scope includes turnover of all necessary design and quality documentation from the previous mission, any required modifications to Building 226-F and the design, construction and installation of processing equipment, process support systems and buildings, utilities and security features for a capability to produce 50 ppy. The 21-D-511 project will also include transfer, stewardship, and incorporation of select MFFF project government property into the SRPPF project, conversion of the Building 226-2F warehouse building into a high-fidelity training facility, and design and construction of support facilities. Given the special nuclear material (SNM) expected during operations in the SRPPF, Building 226-F will be a Hazard Category 2, Security Category I facility.

The SRPPF project has identified the following subprojects:

Utilities, Site, and Infrastructure Subproject (21-D-511-01): This subproject will include: early preparation and installation for all temporary facilities, utilities (above and below ground) and other general temporary infrastructure necessary to support mobilization and onboarding of construction resources, storage / laydown of construction materials and equipment, shop / fabrication / work areas, etc., to support initiation of SRPPF construction activities; and, final site work including installation of buried process support utilities and a waste transfer line, and demolition and removal of any unneeded MFFF temporary support buildings, and final roadways and grading.

Main Process Buildings Subproject (21-D-511-02): The Main Process Building includes design, procurement, 226-F construction, including CD-3A removal of equipment, partially installed commodities, and coatings from 226-F, testing and start-up of structures, systems and components necessary to produce a minimum of 50 ppy, and upgrade a facility to house first shift of Protection Force safeguards and security staff for training and construction interface purposes during overall project construction.

Administration Buildings Subproject (21-D-511-03): The Administration Building Subproject will include design and construction of an approximately 50,000 square foot new Maintenance and Construction support building. This primary mission need is to provide office space for operational management and support personnel. The Maintenance and Construction support building will be constructed early in the project schedule to allow for offices and management support during construction and start-up. The subproject will be integrated with the completion of the final phase of the Utilities, Site, and Infrastructure Subproject.

Safeguards and Security Subproject (21-D-511-04): This subproject will include design and construction of entry control facilities, security fencing, reconfigure and remodel of Building 706-4F building for protective forces and other security infrastructure.

Training and Operations Center Subproject (21-D-511-05): The Training and Operations Center Subproject includes conversion of the Building 226-2F warehouse building into a high-fidelity training facility, both classroom and hands-on equipment training. This high-fidelity training facility will contain nearly identical process gloveboxes and equipment lines for key processes, including balance of plant systems, to what will be installed in the main process building. This facility will provide the ideal location to perform cold development of future pit builds and train the future pit production workforce at SRS.

Justification

NNSA's ability to produce pits in the required quantities established by the Nuclear Weapons Council (NWC) is an essential component of the nuclear deterrent. An Independent AoA was conducted after CD-0, in accordance with the requirements of Office of Management and Budget (OMB) Circular A-11. Multiple alternatives were analyzed and the AoA identified two preferred alternatives with different construction approaches at two separate locations:

- Refurbishment and repurposing of facilities at the Savannah River Site; and,
- Additional footprint to accommodate pit production requirements at LANL

The NNSA Office of Cost Estimating and Program Evaluation conducted a review of the AoA in October 2017 and recommended that further refinement of the preferred alternatives be completed before selecting an alternative that meets requirements. NNSA contracted with an independent architecture and engineering (A&E) firm to complete the follow-on Engineering Assessment to evaluate two preferred alternatives and two additional alternatives to better inform the selection of an alternative and support conceptual design which was completed on April 20, 2018 along with a workforce analysis.

The NNSA Administrator selected a recommended alternative on May 10, 2018 to repurpose Building 226-F, a partially constructed facility at the SRS, for pit production to meet Department of Defense plutonium pit requirements by 2030. The selected alternative will continue to invest in LANL for the capability to produce 30 pits per year (ppy) in 2026, and to repurpose existing facilities at SRS to produce a capability of 80 ppy (both sites) during 2030. The Chairwoman of the Nuclear Weapons Council provided written certification to Congress regarding the NNSA's recommended alternative.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets.* Funds appropriated under the Plutonium Modernization Program and described in this data sheet may be used for contracted support services to the Federal Project Director and to conduct independent reviews and oversight of design and construction for SRPPF.

Key Performance Parameters (KPPs)

The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance. KPPs will be finalized in support of CD-2 documentation, the preliminary KPPs below will be revised in support of CD-2.

Performance Measure[a]
226-F Demolition and Removal (D&R): Complete demolition and removal of MFFF equipment & utility commodities in 226-F.
50 ppy Process and Equipment: Complete successful Operational Readiness Review including completion of integrated Cold System Testing and turnover of all 50 ppy facility, systems and components identified in the SRPPF Program Requirements Document (PRD) to Weapons Production for initiation of hot operations Process Prove-in activities.
Physical Safeguards and Security (S&S) Infrastructure: Complete successful S&S integrated systems and components testing and reconfiguration of 706-4F including project turnover in support of the 50 PPY SRPPF Process and Equipment Operational Readiness Review.
Training and Operation Center (TOC): Training and Development Center will receive beneficial occupancy approval to allow utilization by the Project for Technology maturation and operational preparations with ultimate turnover to Plutonium Operations
SRPPF Infrastructure: Receive beneficial occupancy to support early project utilization and ultimate operations in accordance with the PRD.

3. Project Cost and Schedule

Financial Schedule

SRPPF funding will be appropriated at the Overall Project level (21-D-511) and be allocated to the subprojects in the tables below. NOTE: Tables reflect funding in outyears beyond CD-4 completion anticipated to be needed for project financial closeout.

[a] These Preliminary Key Performance Parameters were developed as part of the CD-1 package.

Overall Project (21-D-511-01 through 21-D-511-05)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	241,896	241,896	29,870
FY 2022	359,000	359,000	491,026
FY 2023	450,000	450,000	490,000
FY 2024	500,000	500,000	540,000
Total Design	1,550,896	1,550,896	1,550,896
Construction			
FY 2022	100,000	100,000	75,000
FY 2023	220,000	220,000	190,500
FY 2024	328,235	328,235	260,000
FY 2025	984,508	984,508	930,000
FY 2026	1,001,339	1,001,339	950,000
FY 2027	877,000	877,000	900,000
FY 2028	1,100,000	1,100,000	1,041,000
FY 2029	450,000	450,000	361,000
FY 2030	800,000	800,000	893,000
FY 2031	1,000,000	1,000,000	1,000,000
FY 2032	507,788	507,788	366,500
FY 2033	0	0	200,000
FY 2034	0	0	150,000
FY 2035	0	0	51,870
Total Construction	7,368,870	7,368,870	7,368,870
Total Estimated Costs (TEC)			
FY 2021	241,896	241,896	29,870
FY 2022	459,000	459,000	566,026
FY 2023	670,000	670,000	680,500
FY 2024	828,235	828,235	800,000
FY 2025	984,508	984,508	930,000
FY 2026	1,001,339	1,001,339	950,000
FY 2027	877,000	877,000	900,000
FY 2028	1,100,000	1,100,000	1,041,000
FY 2029	450,000	450,000	361,000
FY 2030	800,000	800,000	893,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2031	1,000,000	1,000,000	1,000,000
FY 2032	507,788	507,788	366,500
FY 2033	0	0	200,000
FY 2034	0	0	150,000
FY 2035	0	0	51,870
Total TEC	**8,919,766**	**8,919,766**	**8,919,766**
Other Project Costs (OPC)			
FY 2019	91,313	91,313	39,328
FY 2020	219,900	219,900	143,744
FY 2021	110,000	110,000	184,824
FY 2022	16,000	16,000	38,176
FY 2023	30,000	30,000	30,000
FY 2024	30,000	30,000	30,000
FY 2025	30,000	30,000	30,000
FY 2026	50,000	50,000	50,000
FY 2027	75,000	75,000	75,000
FY 2028	100,000	100,000	100,000
FY 2029	750,000	750,000	700,000
FY 2030	400,000	400,000	440,000
FY 2031	200,000	200,000	100,000
FY 2032	78,021	78,021	100,000
FY 2033	0	0	50,000
FY 2034	0	0	39,162
FY 2035	0	0	30,000
Total OPC[a]	**2,180,234**	**2,180,234**	**2,180,234**
Total Project Costs (TPC)			
FY 2018	0	0	0
FY 2019	91,313	91,313	39, 328
FY 2020	219,900[b]	219,900	143,744
FY 2021	351,896	351,896	214,694
FY 2022	475,000	475,000	604,202
FY 2023	700,000	700,000	710,500

[a] OPC for FY 2018-2021 were provided from Plutonium Sustainment / Savannah River Plutonium Operations program. Beginning in FY 2022 OPC funding was included in the line-item.
[b] Budget authority in FY 2018-2020 was appropriated in the Plutonium Sustainment Program to support planning and design activities for the plutonium strategy.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	858,235	858,235	830,000
FY 2025	1,014,508	1,014,508	960,000
FY 2026	1,051,339	1,051,339	1,000,000
FY 2027	952,000	952,000	975,000
FY 2028	1,200,000	1,200,000	1,141,000
FY 2029	1,200,000	1,200,000	1,061,000
FY 2030	1,200,000	1,200,000	1,333,000
FY 2031	1,200,000	1,200,000	1,100,000
FY 2032	585,809	585,809	466,500
FY 2033	0	0	250,000
FY 2034	0	0	189,162
FY 2035	0	0	81,870
Grand Total	**11,100,000**	**11,100,000**	**11,100,000**

Utilities, Site, and Infrastructure Subproject (21-D-511-01)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	5,000	5,000	741
FY 2022	87,500	87,500	67,259
FY 2023	1,000	1,000	25,500
Total Design	93,500	93,500	93,500
Construction			
FY 2022	20,000	20,000	5,000
FY 2023	60,000	60,000	50,000
FY 2024	70,000	70,000	60,000
FY 2025	80,000	80,000	65,000
FY 2026	20,000	20,000	25,000
FY 2027	146,500	146,500	150,000
FY 2028	10,000	10,000	10,000
FY 2029	10,000	10,000	10,000
FY 2030	50,000	50,000	40,000
FY 2031	0	0	20,000
FY 2032	0	0	31,500

	Budget Authority (Appropriations)	Obligations	Costs
Total Construction	466,500	466,500	466,500
Total Estimated Costs (TEC)			
FY 2021	5,000	5,000	741
FY 2022	107,500	107,500	72,259
FY 2023	61,000	61,000	75,500
FY 2024	70,000	70,000	60,000
FY 2025	80,000	80,000	65,000
FY 2026	20,000	20,000	25,000
FY 2027	146,500	146,500	150,000
FY 2028	10,000	10,000	10,000
FY 2029	10,000	10,000	10,000
FY 2030	50,000	50,000	40,000
FY 2031	0	0	20,000
FY 2032	0	0	31,500
Total TEC	**560,000**	**560,000**	**560,000**
Other Project Costs (OPC)			
FY 2023	500	500	200
FY 2024	10,000	10,000	8,000
FY 2025	500	500	500
FY 2026	500	500	500
FY 2027	500	500	500
FY 2028	500	500	500
FY 2029	20,000	20,000	20,000
FY 2030	27,500	27,500	20,500
FY 2031	0	0	8,000
FY 2032	0	0	1,300
Total OPC	**60,000**	**60,000**	**60,000**
Total Project Costs (TPC)			
FY 2021	5,000	5,000	741
FY 2022	107,500	107,500	72,259
FY 2023	61,500	61,500	75,700
FY 2024	80,000	80,000	68,000
FY 2025	80,500	80,500	65,500
FY 2026	20,500	20,500	25,500
FY 2027	147,000	147,000	150,500
FY 2028	10,500	10,500	10,500
FY 2029	30,000	30,000	30,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2030	77,500	77,500	60,500
FY 2031	0	0	28,000
FY 2032	0	0	32,800
Grand Total	**620,000**	**620,000**	**620,000**

Main Process Buildings (MPB) Subproject (21-D-511-02)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	234,396	234,396	28,832
FY 2022	224,000	224,000	385,564
FY 2023	389,500	389,500	399,000
FY 2024	471,000	471,000	505,500
Total Design	1,318,896	1,318,896	1,318,896
Construction			
FY 2022	80,000	80,000	70,000
FY 2023	139,000	139,000	135,000
FY 2024	148,235	148,235	120,000
FY 2025	708,508	708,508	680,000
FY 2026	891,339	891,339	824,000
FY 2027	704,500	704,500	715,000
FY 2028	989,000	989,000	950,000
FY 2029	238,000	238,000	250,000
FY 2030	739,500	739,500	750,000
FY 2031	1,000,000	1,000,000	950,000
FY 2032	507,788	507,788	300,000
FY 2033	0	0	200,000
FY 2034	0	0	150,000
FY 2035	0	0	51,870
Total Construction	6,145,870	6,145,870	6,145,870
Total Estimated Costs (TEC)			
FY 2021	234,396	234,396	28,832
FY 2022	304,000	304,000	455,564
FY 2023	528,500	528,500	534,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	619,235	619,235	625,500
FY 2025	708,508	708,508	680,000
FY 2026	891,339	891,339	824,000
FY 2027	704,500	704,500	715,000
FY 2028	989,000	989,000	950,000
FY 2029	238,000	238,000	250,000
FY 2030	739,500	739,500	750,000
FY 2031	1,000,000	1,000,000	950,000
FY 2032	507,788	507,788	300,000
FY 2033	0	0	200,000
FY 2034	0	0	150,000
FY 2035	0	0	51,870
Total TEC	**7,464,766**	**7,464,766**	**7,464,766**
Other Project Costs (OPC)			
FY 2019	91,313	91,313	39,328
FY 2020	219,900	219,900	143,744
FY 2021	110,000	110,000	184,824
FY 2022	16,000	16,000	38,176
FY 2023	28,000	28,000	29,200
FY 2024	17,000	17,000	20,300
FY 2025	3,000	3,000	17,000
FY 2026	21,500	21,500	28,500
FY 2027	73,500	73,500	53,500
FY 2028	49,000	49,000	51,400
FY 2029	670,000	670,000	628,000
FY 2030	358,000	358,000	408,000
FY 2031	200,000	200,000	83,000
FY 2032	78,021	78,021	91,100
FY 2033	0	0	50,000
FY 2034	0	0	39,162
FY 2035	0	0	30,000
Total OPC	**1,935,234**	**1,935,234**	**1,935,234**
Total Project Costs (TPC)			
FY 2019	91,313	91,313	39,328
FY 2020	219,900	219,900	143,744
FY 2021	344,396	344,396	213,656
FY 2022	320,000	320,000	493,740

	Budget Authority (Appropriations)	Obligations	Costs
FY 2023	556,500	556,500	563,200
FY 2024	636,235	636,235	645,800
FY 2025	711,508	711,508	697,000
FY 2026	912,839	912,839	852,500
FY 2027	778,000	778,000	768,500
FY 2028	1,038,000	1,038,000	1,001,400
FY 2029	908,000	908,000	878,000
FY 2030	1,097,500	1,097,500	1,158,000
FY 2031	1,200,000	1,200,000	1,033,000
FY 2032	585,809	585,809	391,100
FY 2033	0	0	250,000
FY 2034	0	0	189,162
FY 2035	0	0	81,870
Grand Total	**9,400,000**	**9,400,000**	**9,400,000**

Administration Buildings Subproject (21-D-511-03)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	500	500	49
FY 2022	2,500	2,500	2,451
FY 2023	2,500	2,500	3,000
Total Design	5,500	5,500	5,500
Construction			
FY 2023	1,000	1,000	500
FY 2024	20,000	20,000	15,000
FY 2025	21,000	21,000	15,000
FY 2026	1,000	1,000	1,000
FY 2027	1,000	1,000	1,000
FY 2028	1,000	1,000	1,000
FY 2029	2,000	2,000	1,000
FY 2030	5,500	5,500	3,000
FY 2031	0	0	5,000
FY 2032	0	0	10,000
Total Construction	52,500	52,500	52,500

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Costs (TEC)			
FY 2021	500	500	49
FY 2022	2,500	2,500	2,451
FY 2023	3,500	3,500	3,500
FY 2024	20,000	20,000	15,000
FY 2025	21,000	21,000	15,000
FY 2026	1,000	1,000	1,000
FY 2027	1,000	1,000	1,000
FY 2028	1,000	1,000	1,000
FY 2029	2,000	2,000	1,000
FY 2030	5,500	5,500	3,000
FY 2031	0	0	5,000
FY 2032	0	0	10,000
Total TEC	**58,000**	**58,000**	**58,000**
Other Project Costs (OPC)			
FY 2023	500	500	200
FY 2024	2,000	2,000	1,000
FY 2025	1,000	1,000	2,000
FY 2026	500	500	500
FY 2027	500	500	500
FY 2028	500	500	500
FY 2029	10,000	10,000	7,000
FY 2030	7,000	7,000	5,000
FY 2031	0	0	3,000
FY 2032	0	0	2,300
Total OPC	**22,000**	**22,000**	**22,000**
Total Project Costs (TPC)			
FY 2021	500	500	49
FY 2022	2,500	2,500	2,451
FY 2023	4,000	4,000	3,700
FY 2024	22,000	22,000	16,000
FY 2025	22,000	22,000	17,000
FY 2026	1,500	1,500	1,500
FY 2027	1,500	1,500	1,500
FY 2028	1,500	1,500	1,500
FY 2029	12,000	12,000	8,000
FY 2030	12,500	12,500	8,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2031	0	0	8,000
FY 2032	0	0	12,300
Grand Total	**80,000**	**80,000**	**80,000**

Safeguards and Security Subproject (21-D-511-04)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	1,000	1,000	124
FY 2022	20,000	20,000	15,376
FY 2023	50,000	50,000	50,000
FY 2024	29,000	29,000	34,500
Total Design	100,000	100,000	100,000
Construction			
FY 2024	40,000	40,000	30,000
FY 2025	25,000	25,000	20,000
FY 2026	25,000	25,000	20,000
FY 2027	25,000	25,000	20,000
FY 2028	100,000	100,000	80,000
FY 2029	200,000	200,000	100,000
FY 2030	5,000	5,000	100,000
FY 2031	0	0	25,000
FY 2032	0	0	25,000
Total Construction	420,000	420,000	420,000
Total Estimated Costs (TEC)			
FY 2021	1,000	1,000	124
FY 2022	20,000	20,000	15,376
FY 2023	50,000	50,000	50,000
FY 2024	69,000	69,000	64,500
FY 2025	25,000	25,000	20,000
FY 2026	25,000	25,000	20,000
FY 2027	25,000	25,000	20,000
FY 2028	100,000	100,000	80,000
FY 2029	200,000	200,000	100,000
FY 2030	5,000	5,000	100,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2031	0	0	25,000
FY 2032	0	0	25,000
Total TEC	**520,000**	**520,000**	**520,000**
Other Project Costs (OPC)			
FY 2023	500	500	200
FY 2024	500	500	500
FY 2025	500	500	500
FY 2026	500	500	500
FY 2027	500	500	500
FY 2028	50,000	50,000	45,000
FY 2029	50,000	50,000	45,000
FY 2030	7,500	7,500	6,500
FY 2031	0	0	6,000
FY 2032	0	0	5,300
Total OPC	**110,000**	**110,000**	**110,000**
Total Project Costs (TPC)			
FY 2021	1,000	1,000	124
FY 2022	20,000	20,000	15,376
FY 2023	50,500	50,500	50,200
FY 2024	69,500	69,500	65,000
FY 2025	25,500	25,500	20,500
FY 2026	25,500	25,500	20,500
FY 2027	25,500	25,500	20,500
FY 2028	150,000	150,000	125,000
FY 2029	250,000	250,000	145,000
FY 2030	12,500	12,500	106,500
FY 2031	0	0	31,000
FY 2032	0	0	30,300
Grand Total	**630,000**	**630,000**	**630,000**

Training and Operations Center Subproject (21-D-511-05)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	1,000	1,000	124
FY 2022	25,000	25,000	20,376
FY 2023	7,000	7,000	12,500
Total Design	33,000	33,000	33,000
Construction			
FY 2023	20,000	20,000	5,000
FY 2024	50,000	50,000	35,000
FY 2025	150,000	150,000	150,000
FY 2026	64,000	64,000	80,000
FY 2027	0	0	14,000
Total Construction	284,000	284,000	284,000
Total Estimated Costs (TEC)			
FY 2021	1,000	1,000	124
FY 2022	25,000	25,000	20,376
FY 2023	27,000	27,000	17,500
FY 2024	50,000	50,000	35,000
FY 2025	150,000	150,000	150,000
FY 2026	64,000	64,000	80,000
FY 2027	0	0	14,000
Total TEC	**317,000**	**317,000**	**317,000**
Other Project Costs (OPC)			
FY 2023	500	500	200
FY 2024	500	500	200
FY 2025	25,000	25,000	10,000
FY 2026	27,000	27,000	20,000
FY 2027	0	0	20,000
FY 2028	0	0	2,600
Total OPC	**53,000**	**53,000**	**53,000**
Total Project Costs (TPC)			
FY 2021	1,000	1,000	124
FY 2022	25,000	25,000	20,376
FY 2023	27,500	27,500	17,700

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	50,500	50,500	35,200
FY 2025	175,000	175,000	160,000
FY 2026	91,000	91,000	100,000
FY 2027	0	0	34,000
FY 2028	0	0	2,600
Grand Total	**370,000**	**370,000**	**370,000**

4. **Details of Project Cost Estimate**

Overall Project (21-D-511-01 through 21-D-511-05)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	1,380,000	TBD	N/A
Contingency	170,896	TBD	N/A
Total Design	1,550,896	TBD	N/A
Construction		TBD	
Site Preparation	465,000	TBD	N/A
Equipment	762,500	TBD	N/A
Construction	4,262,500	TBD	N/A
Contingency	1,289,766	TBD	N/A
Total Construction	6,779,766	TBD	N/A
Other TEC (if any)		TBD	
Cold Startup	426,104	TBD	N/A
Contingency	163,000	TBD	N/A
Total, Other TEC	589,104	TBD	N/A
Total Estimated Cost	**8,919,766**	**TBD**	**N/A**
Contingency, TEC	*1,623,662*	*TBD*	*N/A*
Other Project Cost (OPC)			

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
OPC except D&D			
Conceptual Planning & Design	300,000	TBD	N/A
Post CD-1 OPC Costs[a]	1,705,234	TBD	N/A
Contingency	175,000	TBD	N/A
Total, OPC	**2,180,234**	**TBD**	**N/A**
Contingency, OPC	*175,000*	*TBD*	*N/A*
Total Project Cost	**$11,100,000[b]**	**$11,100,000**	**N/A**
Total Contingency (TEC+OPC)	***1,798,662***	***TBD***	***N/A***

Utilities, Site, and Infrastructure Subproject (021-D-511-01)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	85,000	TBD	N/A
Contingency	8,500	TBD	N/A
Total Design	93,500	TBD	N/A
Construction		TBD	
Site Preparation	20,000	TBD	N/A
Equipment	20,000	TBD	N/A
Construction	266,500	TBD	N/A
Contingency	100,000	TBD	N/A
Total Construction	406,500	TBD	N/A
Other TEC (if any)		TBD	
Cold Startup	50,000	TBD	N/A
Contingency	10,000	TBD	N/A
Total, Other TEC	60,000	TBD	N/A
Total Estimated Cost	**560,000**	**TBD**	**N/A**
Contingency, TEC	*118,500*	*TBD*	*N/A*

[a] Includes support for NEPA, Regulatory / Permitting, Startup and Commissioning

[b] This value represents the CD-1 approved high end of the range.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Other Project Cost (OPC)			
OPC except D&D		TBD	
Post CD-1 OPC Costs[a]	50,000	TBD	N/A
Contingency	10,000	TBD	N/A
Total, OPC	**60,000**	**TBD**	**N/A**
Contingency, OPC	10,000	TBD	*N/A*
Total Project Cost	**620,000**	**TBD**	**N/A**
Total Contingency (TEC+OPC)	***128,500***	***TBD***	***N/A***

Main Process Buildings Subproject (21-D-511-02)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	1,170,000	TBD	N/A
Contingency	148,896	TBD	N/A
Total Design	1,318,896	TBD	N/A
Construction		TBD	
Site Preparation	400,000	TBD	N/A
Equipment	700,000	TBD	N/A
Construction	3,540,000	TBD	N/A
Contingency	1,064,766	TBD	N/A
Total Construction	5,704,766	TBD	N/A
Other TEC (if any)		TBD	
Cold Startup	301,104	TBD	N/A
Contingency	140,000	TBD	N/A
Total, Other TEC	441,104	TBD	N/A
Total Estimated Cost	**7,464,766**	**TBD**	**N/A**
Contingency, TEC	*1,353,662*	*TBD*	*N/A*
Other Project Cost (OPC)			

[a] Includes support for NEPA, Regulatory / Permitting, Startup and Commissioning.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
OPC except D&D			
Conceptual Planning & Design	300,000	TBD	N/A
Post CD-1 OPC Costs[a]	1,485,234	TBD	N/A
Contingency	150,000	TBD	N/A
Total, OPC	**1,935,234**	**TBD**	**N/A**
Contingency, OPC	*150,000*	TBD	*N/A*
Total Project Cost	**9,400,000**	**TBD**	**N/A**
Total Contingency (TEC+OPC)	***1,503,662***	***TBD***	***N/A***

Administration Buildings Subproject (21-D-511-03)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	5,000	TBD	N/A
Contingency	500	TBD	N/A
Total Design	5,500	TBD	N/A
Construction		TBD	
Site Preparation	5,000	TBD	N/A
Equipment	2,500	TBD	N/A
Construction	34,000	TBD	N/A
Contingency	5,000	TBD	N/A
Total Construction	46,500	TBD	N/A
Other TEC (if any)		TBD	
Cold Startup	5,000	TBD	N/A
Contingency	1,000	TBD	N/A
Total, Other TEC	6,000	TBD	N/A
Total Estimated Cost	**58,000**	**TBD**	**N/A**
Contingency, TEC	*6,500*	TBD	*N/A*
Other Project Cost (OPC)			
OPC except D&D			

[a] Includes support for NEPA, Regulatory / Permitting, Startup and Commissioning

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Post CD-1 OPC Costs[a]	20,000	TBD	N/A
Contingency	2,000	TBD	N/A
Total, OPC	**22,000**	**TBD**	**N/A**
Contingency, OPC	*2,000*	TBD	*N/A*
Total Project Cost	**80,000**	**TBD**	**N/A**
Total Contingency (TEC+OPC)	***8,500***	***TBD***	***N/A***

Safeguards and Security Subproject (21-D-511-04)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	90,000	TBD	N/A
Contingency	10,000	TBD	N/A
Total Design	100,000	TBD	N/A
Construction		TBD	
Site Preparation	20,000	TBD	N/A
Equipment	20,000	TBD	N/A
Construction	240,000	TBD	N/A
Contingency	80,000	TBD	N/A
Total Construction	360,000	TBD	N/A
Other TEC (if any)		TBD	
Cold Startup	50,000	TBD	N/A
Contingency	10,000	TBD	N/A
Total, Other TEC	60,000	TBD	N/A
Total Estimated Cost	**520,000**	**TBD**	**N/A**
Contingency, TEC	*100,000*	*TBD*	*N/A*

[a] Includes support for NEPA, Regulatory / Permitting, Startup and Commissioning

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Other Project Cost (OPC)			
OPC except D&D			
Post CD-1 OPC Costs[a]	100,000	TBD	N/A
Contingency	10,000	TBD	N/A
Total, OPC	**110,000**	**TBD**	**N/A**
Contingency, OPC	10,000	TBD	*N/A*
Total Project Cost	**630,000**	**TBD**	**N/A**
Total Contingency (TEC+OPC)	***110,000***	***TBD***	***N/A***

Training and Operations Center Subproject (21-D-511-05)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	30,000	TBD	N/A
Contingency	3,000	TBD	N/A
Total Design	33,000	TBD	N/A
Construction		TBD	
Site Preparation	20,000	TBD	N/A
Equipment	20,000	TBD	N/A
Construction	182,000	TBD	N/A
Contingency	40,000	TBD	N/A
Total Construction	262,000	TBD	N/A
Other TEC (if any)		TBD	
Cold Startup	20,000	TBD	N/A
Contingency	2,000	TBD	N/A
Total, Other TEC	22,000	TBD	N/A
Total Estimated Cost	**317,000**	**TBD**	**N/A**
Contingency, TEC	*45,000*	*TBD*	*N/A*
Other Project Cost (OPC)			

[a] Includes support for NEPA, Regulatory / Permitting, Startup and Commissioning

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
OPC except D&D			
Post CD-1 OPC Costs[a]	50,000	TBD	N/A
Contingency	3,000	TBD	N/A
Total, OPC	**53,000**	**TBD**	**N/A**
Contingency, OPC	3,000	TBD	*N/A*
Total Project Cost	**370,000**	**TBD**	**N/A**
Total Contingency (TEC+OPC)	***48,000***	***TBD***	***N/A***

5. **Schedule of Appropriations Requests**

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Outyears	Total
FY 2021	TEC	0	241,896	TBD	TBD	TBD	TBD	TBD	N/A	TBD	TBD
	OPC	326,000	110,000	TBD	TBD	TBD	TBD	TBD	N/A	TBD	TBD
	TPC	326,000	351,896	TBD	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY2022	TEC	0	241,896	445,000	TBD	TBD	TBD	TBD	N/A	TBD	TBD
	OPC	311,213	110,000	30,000	TBD	TBD	TBD	TBD	N/A	TBD	TBD
	TPC	311,213	351,896	475,000	TBD	TBD	TBD	TBD	N/A	9,961,891	11,100,000
FY2023	TEC	0	241,896	459,000	670,000	828,235	984,508	1,001,339	877,000	3,857,788	8,919,766
	OPC	311,213	110,000	16,000	30,000	30,000	30,000	50,000	75,000	1,528,021	2,180,234
	TPC	311,213	351,896	475,000	700,000	858,235	1,014,508	1,051,339	952,000	5,385,809	11,100,000[b]

6. **Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	1Q FY 2032 – 4Q FY 2035
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	4Q FY 2085

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs[c]	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	520	600	27,800	48,100

[a] Includes support for NEPA, Regulatory / Permitting, Startup and Commissioning

[b] This value represents the CD-1 approved high end of the cost estimate range.

[c] Current Life Cycle Costs and Annual Costs are based on an updated Life Cycle Cost Estimate performed in January 2021.

7. D&D Information

The SRPPF plutonium processing capability will be constructed within the existing partially completed 226-F building. This will require demolition and removal of previously installed MFFF equipment and support systems and facilities as necessary to accommodate the new plutonium production mission. Costs for demolition and removal of previously installed MFFF equipment will be part of the Demolition and Removal Subproject.

8. Acquisition Approach

On May 10, 2018, in support of the CD-1, NNSA requested Savannah River (SR) M&O to lead the SRPPF CD-1 Conceptual Design development activities while leveraging the LANL M&O plutonium processing knowledge and ongoing project and operation activities. The SR M&O utilized a LANL subcontract with Merrick to provide the process conceptual design. The SR M&O utilized an affiliate sub-contract relationship with Fluor Inc., located in Greenville S.C., to provide design of the balance of plant systems. The SR M&O was responsible for the nuclear safety and ES&H system conceptual design development while relying on the Physical Security Center of Excellence (PSCOE) from Sandia National Laboratories for the physical security conceptual design.

For preliminary and final design, the SR M&O will utilize sole-source subcontracts with Merrick, Fluor and integrate the PSCOE to complete the integrated SRPPF design. The SR M&O and design partners will be engaging qualified specialty equipment and materials suppliers early in design to improve the quality of design enabling optimum procurements and construction execution. The SR M&O will be responsible for the project design's constructability. The design agent and construction lead under the SR M&O will be an Engineering, Procurement, and Construction (EPC) set of contractors. The SR M&O does not have extensive EPC experience in executing large capital nuclear construction projects. The SR M&O will be the Facility Design Authority (FDA) for the facility, the production equipment, balance of plant support systems and nuclear safety and security systems. The SR M&O is the operational authority and will ensure SRPPF includes operability, maintainability and sustainability requirements and are flowed down, implemented and controlled throughout the project execution. As the project integrator, SR M&O will be responsible for project management and integration of design, procurement, construction and start-up and properly sequencing the project activities and submission of multiple quality CD-3A and phased CD-2/3 Package submittals. LANL will continue to support the FDA by providing process inputs and oversight for specialty process equipment. Lawrence Livermore National Laboratory will also support the FDA and serve as the Weapons Design Agency for the first pit type to be produced at SRS. The SR M&O contract will include Contract Line Item Numbers to execute NNSA capital line items at SR to align the applicable requirements and appropriate incentives to optimize the project execution and completion.

21-D-510 High Explosive Synthesis, Formulation, and Production (HESFP) Facility
Pantex Plant, Amarillo, Texas
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The Fiscal Year (FY) 2023 Request for the High Explosive Synthesis, Formulation, and Production (HESFP) Facility is $108,000,000 of Total Project Costs (TPC). This funding will be used to begin construction of the facility. Estimated outyear funding may be revised in future budget requests as the National Nuclear Security Administration (NNSA) baselines the project in accordance with Department of Energy (DOE) Order (O) 413.3B. The most recent DOE O 413.3B approved Critical Decision (CD) is CD-1, *Approve Alternative Selection and Cost Range*, which was approved on February 11, 2021 with a cost range of $523,000,000 to $739,000,000 and a high-end of the CD-4 schedule range of 4Q FY 2030. Subsequently on September 21, 2021, the Project Management Executive approved a revised CD-1 cost range of $505,000,000 to $699,000,000. The project is funded at $661,060,000, which is not the high-end range of the approved CD-1 estimate. NNSA will continue value engineering efforts to reduce the total cost of the project and revise outyear amounts as design matures. Outyear funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE Order 413.3B.

The FY 2023 Request was informed by an Independent Cost Estimate (ICE) performed in June 2020. The CD-3A, *Site Preparation and Long Lead Procurement*, is expected to be approved no later than 2Q FY 2023.

Significant Changes:
This Construction Project Data Sheet (CPDS) is an update of the Fiscal Year (FY) 2022 CPDS and does not include a new start for the budget year. The Preliminary Design began in September 2021, with a planned completion of the final design by 2Q FY 2023. The project is currently working to compress the schedule, and the funding reflects the compression with construction starting earlier. A compressed schedule is being evaluated to reduce the risk that the current schedule will not produce the mission requirements for insensitive high explosives for the W87-1 stockpile modernization program.

A Federal Project Director has been assigned to this project.

Critical Milestone History[a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	Final Design Complete	CD-2	CD-3	D&D Complete	CD-4
FY 2021	01/18/2019	12/31/2019	4Q FY 2020	1Q FY 2022	4Q FY 2022	4Q FY 2022	4Q FY 2026	4Q FY 2025
FY 2022	01/18/2019	12/31/2019	02/11/2021	2Q FY 2023	1Q FY 2024	1Q FY 2024	N/A	4Q FY 2030
FY 2023	01/18/2019	12/31/2019	02/11/2021	2Q FY 2023	1Q FY 2024	1Q FY 2024	N/A	4Q FY 2030

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction

[a] The schedules are estimates and consistent with the high end of the schedule ranges.

D&D Complete – Completion of D&D work
CD-4 – Approve Project Closeout

Fiscal Year	CD-3A
FY 2022	2Q FY 2023[a]
FY 2023	2Q FY 2023[a]

CD-3A – Approve Site Preparation and Long-Lead Procurements

Project Cost History[b]

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	31,000	146,395	177,395	42,605	20,000	62,605	240,000
FY 2022	66,800	636,076	702,876	30,600	N/A	30,600	733,476
FY 2023	51,560	616,840	668,400	30,600	N/A	30,600	699,000

2. Project Scope and Justification

Scope

The project consists of planning, design, and construction of three new buildings, access roads, and perimeters for a single synthesis and formulation facility and a blending facility using the current batch process for synthesis at the Pantex Plant. The total facility square footage, based upon the final Conceptual Design, is expected to be 75,000-100,000 square feet. These structures will replace the aging facilities in Zones 11 and 12 with new facilities in Zone 11 that better support program requirements and meet current codes and standards.

Justification

To ensure the viability of the nation's nuclear deterrent, NNSA needs to modernize and scale its War Reserve high explosive material production capabilities to meet stockpile requirements. Currently, NNSA relies on a single, external Department of Defense vendor, BAE Holston, for large-scale synthesis, formulation, and blending for high explosive products. In the past, Holston has had failures in production resulting in late deliveries. Pantex provides some formulation, blending, and pilot-scale synthesis. Pantex synthesis capabilities are currently unable to provide adequate redundancy in case there are issues with Holston deliveries. Current facilities for formulation and blending at Pantex are aging and in order to meet delivery targets for high explosive products in the nuclear weapon stockpile, NNSA requires a sufficient and timely supply base for High Explosives (HE) products.

The primary benefits from mitigating the risks gaps are as follows:

- Enable the NNSA to meet near and long-term HE material needs for the stockpile by constituting a supply base that brings to bear all the needed capabilities and capacities.
- Eliminates risks associated with aging facilities for synthesis, formulation, blending, and packaging/staging.

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[a] The planned CD-3A approval date is at the high end of the schedule range. The project team is analyzing opportunities to reduce that schedule to move CD-3A approval into FY 2022.

[b] No construction will be performed until the project performance baseline has been validated and CD-3 has been approved.

- Improve the controls systems for formulation and allow for higher confidence in repeatability between batches, as well as better recording and documentation to allow for knowledge and data capture for future generations.
- Reduce or eliminate single points of failure in the HE materials supply chain.
- Provide flexibility and agility with synthesis, formulation, and production of HE to meet future mission needs.
- Avoid heightened and deferred maintenance costs in existing facilities.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. Funds appropriated under this data sheet may be used to provide independent assessments for planning and execution of this project, and contracted support services to the federal project team for oversight and support.

Preliminary Key Performance Parameters (KPPs)
The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Preliminary Performance Measure[a]	Threshold	Objective
HE Formulation, Annual Production Rate	25,000 pounds per year	50,000 pounds per year
HE Synthesis, Annual Production Rate	25,000 pounds per year	50,000 pounds per year
HE Blending	5,000 pounds per batch	N/A
HE Staging/packaging	20,000 pounds, total	N/A

3. Project Cost and Schedule

Financial Schedule[b]

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	30,600	9,138	1,799
FY 2022	20,960	42,422	33,368
FY 2023	0	0	10,330
FY 2024	0	0	6,063
Total, Design	51,560	51,560	51,560
Construction			
FY 2022	23,540	23,540	0
FY 2023	108,000	108,000	21,171

[a] Preliminary Key Performance Parameters were developed as part of the CD-1 approval.
[b] The project has not yet been approved for CD-2, and therefore has not been baselined. Out year funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE Order 413.3B.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	162,000	162,000	52,910
FY 2025	211,000	211,000	196,299
FY 2026	74,360	74,360	147,203
FY 2027	0	0	125,985
FY 2028	0	0	35,332
Total, Construction	578,900	578,900	578,900
Total Estimated Costs			
FY 2021	30,600	9,138	1,799
FY 2022	44,500	65,962	33,368
FY 2023	108,000	108,000	31,501
FY 2024	162,000	162,000	58,973
FY 2025	211,000	211,000	196,299
FY 2026	74,360	74,360	147,203
FY 2027	0	0	125,985
FY 2028	0	0	35,332
Total, TEC	**630,460**	**630,460**	**630,460**
Total Other Project Costs			
FY 2019	3,700	3,700	1,392
FY 2020	3,093	3,093	3,639
FY 2021	400	0	975
FY 2022	0	400	0
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	1,000	1,000	33
FY 2026	22,407	22,407	1,167
FY 2027	0	0	1,649
FY 2028	0	0	8,969
FY 2029	0	0	10,510
FY 2030	0	0	2,266
Total, OPC[a]	**30,600**	**30,600**	**30,600**
Total Project Costs (TPC)			
FY 2019	3,700	3,700	1,392

[a] OPC for FY 2019 and 2020 were provided from the Capability Based Investments program. Starting in FY 2021, OPC funding was included in the line item.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2020	3,093	3,093	3,639
FY 2021	31,000	9,138	2,774
FY 2022	44,500	66,362	33,368
FY 2023	108,000	108,000	31,501
FY 2024	162,000	162,000	58,973
FY 2025	212,000	212,000	196,332
FY 2026	96,767	96,767	148,370
FY 2027	0	0	127,634
FY 2028	0	0	44,301
FY 2029	0	0	10,510
FY 2030	0	0	2,266
Grand Total	**661,060**	**661,060**	**661,060**[a]

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	38,930	50,200	N/A
Federal Support	2,500	3,200	N/A
Contingency	10,130	13,400	N/A
Total, Design	51,560	66,800	N/A
Construction			
Site Work	16,130	17,000	N/A
Process Equipment	97,320	50,000	N/A
Construction	381,450	450,000	N/A
Federal Support	7,500	8,800	N/A
Contingency	114,440	110,276	N/A
Total, Construction	616,840	636,076	N/A
Total Estimated Cost	668,400	702,876	N/A

[a] The total project cost in section 3 does not equal the total project cost in section 4 due to ongoing efforts to reduce the cost of the project through value engineering.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Contingency, TEC	*124,570*	*123,676*	*N/A*
Other Project Cost (OPC)			
OPC			
Pre-Conceptual Activities	1,200	1,200	N/A
Conceptual Design	5,593	5,593	N/A
Start-up	17,000	17,000	N/A
Equipment Move	3,186	4,000	N/A
Federal Start-up Support	1,188	N/A	N/A
Contingency	2,433	2,807	N/A
Total, OPC	**30,600**	**30,600**	**N/A**
Contingency, OPC	*2,433*	*2,807*	*N/A*
Total Project Cost	**699,000**	**733,476**	**N/A**
Total Contingency (TEC+OPC)	***127,003***	***126,483***	***N/A***

5. Schedule of Appropriations Requests[a]

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2022	FY 2023	FY 2024	FY2025	FY2026	FY2027	Out Years	Total
FY 2021	TEC	31,000	20,000	54,000	60,395	12,000	0	N/A	N/A	177,395
	OPC	15,000	500	500	7,500	20,000	19,105	N/A	N/A	62,605
	TPC	46,000	20,500	54,500	67,895	32,000	19,105	N/A	N/A	240,000
FY 2022	TEC	30,600	44,500	N/A	N/A	N/A	N/A	N/A	627,776	702,876
	OPC	7,193	0	N/A	N/A	N/A	N/A	N/A	23,407	30,600
	TPC	37,793	44,500	N/A	N/A	N/A	N/A	N/A	651,183	733,476
FY 2023	TEC	30,600	44,500	108,000	162,000	211,000	74,360	0	0	630,460
	OPC	7,193	0	0	0	1,000	22,407	0	0	30,600
	TPC	37,793	44,500	108,000	162,000	212,000	96,767	0	0	661,060

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2030
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	4Q FY 2080

[a] The project has not yet been approved for CD-2, and therefore has not been baselined. Outyear funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE Order 413.3B.

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Cost		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	$39.0	$39.0	$1,952	$1,952

7. D&D Information

The facility is planned for construction in a greenfield, so no D&D is needed to enable the construction. The disposition of the existing facilities that will be obsolete/excess once the HESFP project new construction is completed has been captured in NNSA's Master Asset Plan and will be evaluated for future funding outside of the HESFP line item.

	Square Feet
New area being constructed by this project at Pantex Plant	100,000
Area of D&D at the Pantex Plant	0
Area at the Pantex Plant to be transferred, sold, and/or D&D outside the project including area previously "banked"	100,000
Area of D&D in this project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the project including area previously "banked"	0
Total area eliminated	100,000

8. Acquisition Approach

The conceptual design was led by the M&O contractor utilizing a subcontracted Architectural and Engineering firm. The Acquisition Strategy is planned as a design-bid-build with the design and construction as two separate project phases. The design phase strategy will be led by the M&O contractor utilizing a firm fixed price subcontract to an Architectural and Engineering firm. The project has incorporated the award of an M&O firm fixed price subcontract for site preparation work and long lead procurement, but the main construction phase strategy will be developed as part of the CD-2 approval.

18-D-690, Lithium Processing Facility
Y-12 National Security Complex, Oak Ridge, Tennessee
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2023 Request for the Lithium Processing Facility (LPF) is $216,886,000 The current Critical Decision (CD)-1 was approved on December 31, 2019 by the Chief Executive for Project Management with a high end cost range of $1,645,000,000 [total project cost (TPC)]. Outyear funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE Order 413.3B.

Significant Changes:
This project is not a new start. The most recent DOE Order 413.3B Critical Decision (CD) was CD-1, approved on December 31, 2019. Based on this approval, in FY 2021 the Architect and Engineering (A/E) subcontract was awarded and the preliminary design effort was initiated. At the end of FY 2022, the design will be approximately 50% complete.

The project experienced minimal COVID-19 impacts to date primarily associated with workspace cleaning requirements in building 1099.

FY 2023 funds will be used for design, CD-3A long-lead and site preparation procurements.

Preliminary and final design, construction and Other Project costs (OPC) will continue to be executed through line item funding specifically appropriated for the project, as started in FY 2021. Prior to FY 2021, OPCs were funded from Capability Based Investments and Lithium Sustainment, except in FY 2018 where funding appropriated under the project funded conceptual design.

Critical Milestone History

Fiscal Quarter or Date[a]

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2019	06/10/2015	01/19/2018	2Q FY 2019	1Q FY 2021	2Q FY 2022	1Q FY 2021	N/A	2Q FY 2027
FY 2020	06/10/2015	02/28/2019	3Q FY 2019	2Q FY 2022	2Q FY 2022	2Q FY 2022	N/A	3Q FY 2027
FY 2021	06/10/2015	02/28/2019	12/31/2019	3Q FY 2024	3Q FY 2024	3Q FY 2024	N/A	4Q FY 2031
FY 2022	06/10/2015	02/28/2019	12/31/2019	1Q FY 2026[b]	2Q FY 2025[c]	1Q FY 2026	N/A	4Q FY 2031
FY 2023	06/10/2015	02/28/2019	12/31/2019	1Q FY 2026	2Q FY 2025	1Q FY 2026	N/A	4Q FY 2031

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable).
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete –Completion of D&D work
CD-4 – Approve Start of Operations or Project Complete

Fiscal Year	CD-3A
FY 2019	N/A

[a] Project schedules are estimates until the project baseline is approved at CD-2.
[b] CD-2 and CD-3 dates adjusted to include addition of schedule contingency previously omitted from CPDS.
[c] Final Design Completion date adjusted to include addition of schedule contingency previously omitted from CPDS.

Fiscal Year	CD-3A
FY 2020	4Q FY 2021
FY 2021	4Q FY 2022
FY 2022	4Q FY 2023
FY 2023	4Q FY 2023

CD-3A – Long-Lead Procurements and Site Preparation – Long-lead procurements consists of critical equipment such as lathes, mills, and presses. Site preparation work includes demolition of slabs and underground utilities; removal of unsuitable soils and backfill; and installation of site access controls, water drainage features, retention basins, and temporary facilities.

Project Cost History[a]

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2019	120,000	530,000	650,000	70,000	0	70,000	720,000
FY 2020	125,000	525,000	650,000	70,000	0	70,000	720,000
FY 2021	384,000	1,161,000	1,545,000	100,000	0	100,000	1,645,000
FY 2022	384,000	1,161,000	1,545,000	100,000	0	100,000	1,645,000
FY 2023	384,000	1,161,000	1,545,000	100,000	0	100,000	1,645,000

The project will seek to procure long lead capital equipment and prepare the construction site prior to approval of the project baseline at CD-2.

2. Project Scope and Justification

Scope

The LPF project will design and construct a new facility, at the former Biology complex site on Y-12, to relocate lithium operations and processes currently in Y-12's Building 9204-2 into a safe, reliable, modern building. LPF will be approximately 134,000 SF in size. It will be designed with space for lithium process equipment, shipping and receiving areas, in-process storage areas, and technical and administrative support areas. The LPF project plans to pursue approval of a CD-3A for the long lead scope and site preparation. Long-lead procurements consists of critical equipment such as lathes, mills, and presses. Site preparation work includes demolition of slabs and underground utilities; removal of unsuitable soils and backfill; and installation of site access controls, water drainage features, retention basins, and temporary facilities. The project cost estimate and funding profile may be revised in future budget requests prior to CD-2 to account for improved definition of the design, schedule, and/or risks. Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction. A level III Federal Project Director has been assigned.

Justification

Lithium is an essential element for the refurbishment and modernization of the nuclear weapons stockpile. To support Defense Programs missions, Y-12 maintains capabilities and facilities for the production of lithium components. In addition to supporting Defense Programs missions, lithium capabilities support international agreements, the NNSA Nuclear Smuggling Detection and Deterrence program, the Department of Homeland Security Countering Weapons of Mass Destruction Office, and the Department of Energy (DOE) Office of Science Isotope Business Office.

[a] Project costs are estimates until the project baseline is approved at CD-2.

Production work for lithium and related nonnuclear special materials vital to canned subassemblies is performed in Building 9204-2, which was built in 1943. The facility is oversized for today's mission, is costly to operate, has many operating issues, and has exceeded its expected life. Despite short-term investments to sustain capabilities, conditions in Building 9204-2 remain poor, in part due to a significant amount of deferred maintenance. As an example of impact and concern, the Senate Armed Service Committee in the National Defense Authorization Act of Fiscal Year 2015, acknowledged that: "Portions of the concrete ceiling above equipment that supplies components to the stockpile are spalling as the rebar inside the 60-plus-year-old concrete has corroded due to a desiccant used in the air handling system. Such working conditions are unacceptable if not dangerous." In order to ensure continuity of lithium capabilities, reduce annual operating costs, and increase process efficiencies using safer, more modern, agile, and responsive processes, a new facility must be built. A project specific Analysis of Alternatives (AoA) was completed in 2017. Key evaluation criteria included life-cycle cost, capacity, complexity, schedule, safety, and impact on existing operations. Off-site real estate surveys and facilities assessments were completed and no suitable facilities were identified, therefore the selected preferred alternative was to build a new facility. Due to cost growth between CD-0 and CD-1, primarily due to industrial/process space and office space allocations growth, DOE Cost Estimating and Program Evaluation (CEPE) was prompted to reexamine the AoA. After completing the AoA reexamination process, NNSA leadership re-affirmed the selection of building a new facility.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. Project risk assessment was conducted as part of the CD-1 approval process. Risk management assessments and updates continue as part of the project management. Also, consistent with DOE O 413.3B, earned value information for the LPF design effort will be reported in the Project Assessment and Reporting System (PARS). Funding specifically appropriated for the LPF project may also be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction of the LPF.

Preliminary Key Performance Parameters (KPPs)

The threshold KPPs represent the minimum acceptable performance that the project must achieve. These thresholds are presented with increased detail in the classified Project Requirements Document (PRD). Achievement of the threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The objective KPPs, also detailed in the PRD, represent the desired project performance.

. . .

Performance Measure[a]	Threshold	Objective
Demonstrate capacity to process and produce sufficient lithium material and manufacture sufficient lithium components to meet projected weapons program demands	Threshold Performance Parameters are identified in the Classified Project Requirements Document	Objective Performance Parameters are identified in the Classified Project Requirements Document

3. Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2018	0	0	0
FY 2019	19,000	19,000	6,570
FY 2020	32,000	19,000	7,736
FY 2021	99,405	99,405	29,233[b]
FY 2022	164,902	164,902	165,000

[a] Key Performance Parameters will be approved upon approval of the project baseline.

[b] Updated to reflect actual FY21 TEC cost.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2023	63,693	76,693	167,000
FY 2024	5,000	5,000	8,461
Total Design	384,000	384,000	384,000
Construction			
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	150,193	140,000	100,000
FY 2024	245,770	245,770	205,000
FY 2025	264,000	264,000	335,000
FY 2026	270,000	270,000	260,000
FY 2027	228,000	180,000	165,000
FY 2028	3,037	29,630	50,000
FY 2029	0	26,600	30,000
FY 2030	0	5,000	10,000
FY 2031	0	0	6,000
Total Construction	1,161,000	1,161,000	1,161,000
Total Estimated Costs (TEC)			
FY 2018	0	0	0
FY 2019	19,000	19,000	6,570
FY 2020	32,000	19,000	7,736
FY 2021	99,405	99,405	29,233[a]
FY 2022	164,902	164,902	165,000
FY 2023	213,886	216,693	267,000
FY 2024	250,770	250,770	213,461
FY 2025	264,000	264,000	335,000
FY 2026	270,000	270,000	260,000
FY 2027	228,000	239,000	165,000
FY 2028	3,037	2,230	50,000
FY 2029	0	0	30,000
FY 2030	0	0	10,000
FY 2031	0	0	6,000
Total TEC	**1,545,000**	**1,545,000**	**1,545,000**
Other Project Costs (OPC)			
FY 2015[b]	497	497	88
FY 2016	247	247	637
FY 2017	4,680	4,680	572
FY 2018	5,000	3,661	4,527
FY 2019	0	0	3,261

[a] Updated to reflect actual FY21 TEC cost.
[b] OPC funding in FY 2015-2017 was funded out of Capability Based Investments.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2020	1,000	1,000	0
FY 2021	10,000	10,000	979[a]
FY 2022	3,000	3,000	4,000
FY 2023	3,000	3,000	8,000
FY 2024	10,000	10,000	12,000
FY 2025	16,000	16,000	16,000
FY 2026	20,000	20,000	5,000
FY 2027	22,000	22,000	10,000
FY 2028	4,576	5,915	15,000
FY 2029	0	0	10,000
FY 2030	0	0	5,720
FY 2031	0	0	4,216
Total OPC	**100,000**	**100,000**	**100,000**
Total Project Costs (TPC)			
FY 2015	497	497	88
FY 2016	247	247	637
FY 2017	4,680	4,680	572
FY 2018	5,000	3,661	4,527
FY 2019	19,000	19,000	9,831
FY 2020	33,000	20,000	7,736
FY 2021	109,405	109,405	30,212[b]
FY 2022	167,902	167,902	169,000
FY 2023	216,886	219,693	275,000
FY 2024	260,770	260,770	225,461
FY 2025	280,000	280,000	351,000
FY 2026	290,000	290,000	265,000
FY 2027	250,000	261,000	175,000
FY 2028	7,613	8,145	65,000
FY 2029	0	0	40,000
FY 2030	0	0	15,720
FY 2031	0	0	10,216
Grand Total	**1,645,000**	**1,645,000**	**1,645,000**

[a] Updated to reflect actual FY21 OPC cost.
[b] Updated to reflect actual FY21 TPC cost.

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC))			
Design			
Design	306,000	300,000	N/A
Federal Support	18,000	18,000	
Contingency	60,000	66,000	N/A
Total, Design	384,000	384,000	N/A
Construction			
Site Work	25,045	25,045	N/A
Equipment	417,939	417,939	N/A
Construction	434,018	434,018	N/A
Federal Support	28,000	28,000	N/A
Project Management	66,628	66,628	N/A
Contingency	189,370	189,370	N/A
Total, Construction	1,161,000	1,161,000	N/A
Total Estimated Cost	**1,545,000**	**1,545,000**	N/A
Contingency, TEC	*249,370*	*255,370*	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	23,389	23,389	N/A
Conceptual Planning	7,085	7,085	N/A
Conceptual Design	4,218	4,218	N/A
Other OPC Costs (Startup, ES&H, etc.)	47,698	47,698	N/A
Contingency	17,610	17,610	N/A
Total, OPC	**100,000**	**100,000**	N/A
Contingency, OPC	17,610	17,610	N/A
Total Project Cost	**1,645,000**	**1,645,000**	N/A
Total Contingency (TEC+OPC)	***266,980***	***272,980***	N/A

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Out Years	Total
FY 2019	TEC	51,000	26,200	125,900	201,600	200,000	45,300	0	0	0	650,000
	OPC	11,369	1,000	1,000	1,000	11,936	13,663	17,032	13,000	0	70,000
	TPC	62,369	27,200	126,900	202,600	211,936	58,963	17,032	13,000	0	720,000
FY 2020	TEC	56,000	26,200	125,900	191,600	217,728	32,572	0	0	0	650,000
	OPC	10,074	1,000	1,000	1,000	12,236	16,563	18,132	9,995	0	70,000
	TPC	66,074	27,200	126,900	192,600	229,964	49,135	18,132	9,995	0	720,000
FY 2021	TEC	51,000	99,405	218,902	223,012	250,770	245,312	251,000	147,000	58,599	1,545,000
	OPC	11,424	10,000	3,000	3,000	10,000	16,000	20,000	22,000	4,576	100,000

	TPC	62,424	109,405	221,902	226,012	260,770	261,312	271,000	169,000	63,175	1,645,000
FY 2022	TEC	51,000	99,405	164,902	TBD	TBD	TBD	TBD	TBD	1,229,693	1,545,000
	OPC	11,424	10,000	3,000	TBD	TBD	TBD	TBD	TBD	75,576	100,000
	TPC	62,424	109,405	167,902	TBD	TBD	TBD	TBD	TBD	1,305,269	1,645,000
FY 2023	TEC	51,000	99,405	164,902	213,886	250,770	264,000	270,000	228,000	3,037	1,545,000
	OPC	11,424	10,000	3,000	3,000	10,000	16,000	20,000	22,000	4,576	100,000
	TPC	62,424	109,405	167,902	216,886	260,770	280,000	290,000	250,000	7,613	1,645,000

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2031
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2081

Related Funding requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	73	33	3,666	1,669[a]

7. D&D Information

The location for the new facility is the former Biology Complex at Y-12; however, D&D of the existing facilities is being funded and managed by DOE's Office of Environmental Management through its Y-12 Excess Facilities D&D program. Building 9204-2 houses operations in addition to lithium production, and the plan for the transition of those operations to other facilities is yet to be decided. Once all capabilities have been moved out of Building 9204-2, final D&D of existing facilities will be the responsibility of the DOE Office of Environmental Management.

8. Acquisition Approach

NNSA has contracted with the M&O to award multiple subcontracts of various types. Primary design effort, through the end of the project, will be accomplished via a cost plus award fee subcontract to an Architect/Engineering firm. Various firm fixed price subcontracts, with a firm fixed price option to fabricate, will be used for most of the specialized process equipment design and procurement. Specific to the machining lathe/mill complex prototype, a cost plus incentive fee subcontract will be used for design phase with an optional firm fixed price for fabrication. The project will utilize Construction Manager at Risk (CMR) services. The first phase, providing constructability reviews and providing cost saving design/construction recommendations, will be via a time and materials subcontract. The second phase will be an optional firm fixed price subcontract for the construction of the LPF facility. As allowed by Order 413.3B, Change 6, the project scope may be phased into smaller subprojects with phased CD-2/3 approvals and CD-3A for site preparation and long lead procurements.

[a] Previous Total Estimate incorrectly included capital acquisition and D&D costs.

18-D-650, Tritium Finishing Facility
Savannah River Site, Aiken, South Carolina
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary:

This Construction Project Data Sheet (CPDS) is an update of the FY 2022 CPDS and does not include a new start for the budget year. The FY 2023 Request for the Tritium Finishing Facility (TFF) Project is $73,300,000. The current preliminary Total Project Cost (TPC) range approved at CD-1 on December 20, 2019, is $305,000,000 to $640,000,000

Significant Changes:

In FY 2023, $73,300,000 is requested to continue design activities towards 30% design complete in FY 2023 and 60% design complete in FY 2025 for the Process Buildings, to complete design and begin construction for the Site Preparation and Warehouse Construction Subproject, and to prepare for long-lead procurements.

The cost and schedule information shown in the FY 2023 PDS has been updated only within the boundary of the current approved CD-1 cost range and CD-4 date as compared to the FY 2022 PDS, to align planning with the increased budget requested for FY 2023. The overall project schedule was re-evaluated based on an FY 2021 NNSA review conducted on the Management and Operations (M&O) contractor's submittal of a risk-informed Design Performance Baseline (DPB) for expected critical path to achieve CD-2/3 approval for the entire TFF project. Based on NNSA input, the M&O contractor updated the DPB to achieve CD-2/3, which NNSA reviewed and approved in February 2022. The FY 2023 CPDS continues to support the approved CD-1 cost and schedule range, but NNSA will continue evaluating the project's funding profile and estimate to determine if the current CD-1 high end ranges for TPC and CD-4 would still be considered bounding. NNSA is continuing to explore opportunities that could result in cost avoidances, including acquisition strategies and scope trade-offs that can meet programmatic requirements while staying within the approved CD-1 cost and schedule ranges.

An in-depth cost estimate for completing design and achieving CD-2/3 approval was developed in June 2021. Discussions with NNSA senior leadership were then held to consider options and decide on the best path forward for the project. As the M&O Contractor has considered the overall project schedule, it has revised the expected critical path of the project, resulting in changes to the project schedule in the FY 2023 CPDS. CD-2/3 for the Site Preparation and Warehouse Construction Subproject (18-D-650-01) must be achieved by Q4 of FY 2023. The project is required to coordinate relocation of the H-Area New Manufacturing (HANM) 13.8kV power supply, scope included within the Site Preparation and Warehouse Construction Subproject (18-D-650-01), to ensure 13.8kV power line relocation completion / turnover back to the Program for a critical production operations Thermal Cycling Absorption Process (TCAP) outage to support the Tritium Extraction Facility extraction schedule. Accordingly, the Site Preparation and Warehouse Construction Subproject (18-D-650-01) CD-2/3 is currently shown in Q4 of FY 2023, to ensure 13.8kV power line relocation completion / turnover back to the Program by February 2024.

In FY 2021, the overall project schedule necessary to achieve readiness for CD-2 was finalized, including activities to begin design for the CD-3A for long lead procurement in support of the Process Buildings Subproject (18-D-650-02), and the CD-2/3 for the Site Preparation & Warehouse Construction Subproject (18-D-650-01). The M&O awarded an affiliated subcontract with Fluor Federal Services for the design of the Process facility. The Project team achieved approximately 90% complete the design for the Site Preparation & Warehouse Construction Subproject (18-D-650-01) and worked to advance the Process Buildings Subproject (18-D-650-02) toward 30% design complete.

The most recent Critical Decision (CD) is CD-1, approved December 20, 2019. The CD-4 range is 4Q FY 2029 - 4Q FY 2031. A Federal Project Director has been appointed. The FPD is certified as a Level 1 FPD and is pursuing certification as a Level III FPD. The Director, SRS APMO, the FPD's supervisor, is certified as a Level IV FPD.

The TFF subprojects are described below:

Site Preparation & Warehouse Construction Subproject (18-D-650-01): The subproject will demolish three warehouses, build one new replacement warehouse, relocate a cooling tower, relocate the Limited Area fence, and relocate utilities to provide space for the process building constructions.

Process Buildings Subproject (18-D-650-02): The Process Building Subproject will provide the two main structures of the TFF: Building 1 (249-12H) is a Hazard Category (HC)-2 nuclear facility and Building 2 (249-23H) is a below HC-3 radiological facility. 249-12H is approximately 19,000 square feet and will house the systems processing tritium-loaded gas transfer systems. 249-13H is approximately 10,000 square feet and will house the reservoir handling processes conducted prior to tritium loading. The envisioned project is intended to replace key capabilities in H-Area Old Manufacturing (HAOM), a 1950s vintage building that does not meet current codes and standards and that presents a risk to the tritium mission due to the age of the building and systems as well as susceptibility to natural phenomena. HAOM supports an extensive array of mission critical capabilities, such as the pre-loading process, inert loading, reservoir acceptance, assembly of reservoir components, packaging, storage, shipping, and metallurgical analysis. These capabilities directly support shipments of Gas Transfer Systems (GTS) and Limited Life Component Exchanges (LLCE) to the Department of Defense (DoD).

The subproject will also provide a new fire protection system, security systems, final site civil work, startup testing of new systems, and commissioning.

Critical Milestone History

Overall Project (18-D-650) and Process Buildings Subproject (18-D-650-02)

Fiscal Quarter or Date[a]

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	06/10/2015	01/28/2017	2Q FY2018	4Q FY2022	2Q FY2022	4Q FY2022	N/A	4Q FY2027
FY 2019	06/10/2015	01/28/2017	3Q FY2018	2Q FY2023	2Q FY2022	2Q FY2023	N/A	4Q FY2029
FY 2020	06/10/2015	01/28/2017	4Q FY2019	2Q FY2024	4Q FY2023	2Q FY2024	N/A	4Q FY2031
FY 2021	06/10/2015	01/28/2017	12/20/2019	1Q FY2024	1Q FY2024	1Q FY2024	N/A	4Q FY2031
FY 2022	06/10/2015	01/28/2017	12/20/2019	1Q FY2024	1Q FY2024	1Q FY2024	N/A	4Q FY2031
FY 2023	06/10/2015	01/28/2017	12/20/2019	3Q FY2026	3Q FY2026	3Q FY2026	N/A	4Q FY2031

[a] The schedules are only estimates until the project baseline is approved. Dates listed correspond to the high end of the schedule range.

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	06/10/2015	01/28/2017	2Q FY2018	4Q FY2022	2Q FY2022	4Q FY2022	N/A	4Q FY2027
FY 2019	06/10/2015	01/28/2017	3Q FY2018	2Q FY2023	2Q FY2022	2Q FY2023	N/A	4Q FY2029
FY 2020	06/10/2015	01/28/2017	4Q FY2019	2Q FY2024	4Q FY2023	2Q FY2024	N/A	4Q FY2031
FY 2021	06/10/2015	01/28/2017	12/20/2019	1Q FY2024	1Q FY2024	1Q FY2024	N/A	4Q FY2031
FY 2022	06/10/2015	01/28/2017	12/20/2019	1Q FY2024	1Q FY2024	1Q FY2024	N/A	4Q FY2031
FY 2023	06/10/2015	01/28/2017	12/20/2019	3Q FY2026	3Q FY2026	3Q FY2026	N/A	4Q FY2031

Site Preparation & Warehouse Construction Subproject (18-D-650-01)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2022	06/10/2015	01/28/2017	12/20/2019	1Q FY2024	1Q FY2024	1Q FY2024	N/A	2Q FY2025
FY 2023	06/10/2015	01/28/2017	12/20/2019	4Q FY2023	4Q FY2023	4Q FY2023	N/A	2Q FY2025

NOTE: This CPDS reflects a CD-2/3 for the Site Preparation and Warehouse Construction Subproject in 4Q FY2023 to support obtaining CD-2/3 in FY2023 and commencing Site Preparation construction work in FY2023, as described in the Significant Changes update for this CPDS.

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2/3 Site Preparation & Warehouse Construction Subproject – demolishing existing structures, relocating a fence, relocating a cooling tower, move access roads, install warehouse space, and relocate utilities to clear and prepare the site for new construction or refurbishment of existing buildings.

CD-4 – Site Preparation & Warehouse Construction Subproject complete

CD-2/3 – Approve Performance Baseline; Approve Start of Construction

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

D&D Complete –D&D will not be performed as part of this project, due to the nature of decontaminating tritium process systems

CD-4 – Approve Start of Operations or Project Complete

Fiscal Quarter or Date

Fiscal Year	CD-3A
FY 2018	1Q FY 2020
FY 2019	1Q FY 2020
FY 2020	1Q FY 2022
FY 2021	3Q FY 2021
FY 2022	3Q FY 2024
FY 2023	3Q FY 2024

CD-3A – Long Lead Procurement of critical equipment

Project Cost History

Overall Project (18-D-650)

(Dollars in Thousands)[a]

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	76,000	349,000	425,000	74,000	0	74,000	499,000
FY 2019	76,000	425,042	501,042	74,000	0	74,000	575,042
FY 2020	79,000	464,829	543,829	75,000	0	75,000	618,829
FY 2021	80,000	482,300	562,300	77,700	0	77,700	640,000
FY 2022	144,000	418,300	562,300	77,700	0	77,700	640,000
FY 2023	150,300	412,000	562,300	77,700	0	77,700	640,000

Site Preparation & Warehouse Construction Subproject (18-D-650-01)

(Dollars in Thousands)[a]

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2022	8,100	16,700	24,800	5,500	0	5,500	30,300
FY 2023	8,100	16,700	24,800	5,500	0	5,500	30,300

Process Buildings Subproject (18-D-650-02)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2022	135,900	401,600	537,500	72,200	0	72,200	609,700
FY 2023	142,200	395,300	537,500	72,200	0	72,200	609,700

[a] The costs are only estimates until the project performance baseline is approved.

The Site Preparation & Warehouse Construction Subproject achieved approximately 90% design complete in FY 2021 and this will serve as input into the Process Building Subproject design. The project will initiate a CD-3A long-lead procurement of a mass spectrometer in FY 2024. Start of construction activities are dependent upon completion of the design for the Process Buildings Subproject.

2. Project Scope and Justification

Scope

The TFF project will construct two new buildings to relocate tritium and deuterium processes currently in H-Area Old Manufacturing into safe, reliable, modern buildings. The first, hardened building (estimated at 17,000 +/- 10% square feet) will house tritium equipment processes, and the second (estimated at 8,000 +/-10% square feet) will house non-nuclear process equipment. To make room for the new buildings, existing warehouses will be demolished and replaced elsewhere. A hardened corridor (estimated at 1,000 +/- 10% square feet) will be constructed to allow for transportation of tritium containing components to and from the TFF structure. Scope for the project also includes project design, safety basis development, and relocation of utilities, fences, and an access road.

Site Preparation & Warehouse Construction Subproject (18-D-650-01): A subproject is requested for dismantlement and removal of structures, systems and components, re-establishing warehouse space and site preparation to reduce project schedule and subsequent cost. The subproject will demolish three warehouses, build one new approximately 9,000 square foot replacement warehouse, relocate a cooling tower, relocate the Limited Area fence, relocate utilities to provide space for the process building construction and provide an access road.

Process Buildings Subproject (18-D-650-02): The Process Buildings Subproject will provide the two main structures of the TFF: Building 1 is a Hazard Category (HC)-2 nuclear facility and Building 2 is a HC-3 facility. The envisioned project was intended to replace key capabilities in H-Area Old Manufacturing (HAOM), a 1950s vintage building that does not meet current codes and standards and that presents a risk to the tritium mission due to the age of the building and systems as well as susceptibility to natural phenomena. HAOM supports an extensive array of mission critical capabilities, such as the pre-loading process, inert loading, reservoir acceptance, assembly of reservoir components, packaging, storage, shipping, and metallurgical analysis. 249-12H will house the tritium-filled reservoir processes: reservoir acceptance, assembly of reservoir components, packaging, storage and shipping. 249-13H will house the inert systems: receipt inspection, pre-loading process, inert loading and metallurgical analysis. These capabilities directly support shipments of Gas Transfer Systems (GTS) and Limited Life Component Exchanges (LLCE) to the Department of Defense (DoD).

This subproject will also provide a new fire protection system, security systems, final site civil work, startup testing of new systems, and commissioning. This subproject will also construct a hardened corridor to connect TFF to existing facilities through which tritium-containing components can be transported.

Justification

The NNSA Stockpile Stewardship mission and the Tritium-related missions require the specific capability of providing tritium and deuterium-filled reservoirs to the Department of Defense, a capability that must be ensured well into the foreseeable future. These capabilities include, but are not limited to, receipt, inspection, inert loading, pre-loading, metallography, surveillance, container storage, packaging, and shipping. These critical capabilities are currently housed in a 60-year-old building, H-Area Old Manufacturing. The infrastructure of the building has deteriorated and is well beyond expected end-of-life. Critical capabilities are now housed in areas that create a substantial risk to the enduring Tritium mission. Infrastructure failures have increased, leading to increased safety, security, maintenance and operating costs.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements for CD-1 have been met. The project funding profile may be revised in future budget requests prior to CD-2 to account for improved definition of the design, schedule, and risks.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction.

Preliminary Key Performance Parameters (KPPs)

The threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure	Threshold	Objective
Demonstrate the operational capability of inert loading at a capacity rate that can meet the annualized threshold requirement based on an assumed 40 weeks of equipment availability per year.	Classified	Classified
Demonstrate the operational capability of the pre-loading process at a capacity rate that can meet the annualized threshold requirement based on 40 weeks of equipment availability per year.	Classified	Classified

3. Financial Schedule

TFF funding is appropriated, apportioned and allocated at the Overall Project level (18-D-650), then distributed within the Overall Project to the subprojects, as shown in below.

Site Preparation & Warehouse Construction Subproject (18-D-650-01)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	4,000	4,000	4,000
FY 2021	2,500	2,500	2,000
FY 2022	700	700	1,000
FY 2023	900	900	1,100
FY 2024	0	0	0
Total, Design	8,100	8,100	8,100
Construction			
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	14,000	14,000	5,700
FY 2024	2,700	2,700	11,000
FY 2025	0	0	0
FY 2026	0	0	0
FY 2027	0	0	0
FY 2028	0	0	0
FY 2029	0	0	0
FY 2030	0	0	0
FY 2031	0	0	0
Total, Construction	16,700	16,700	16,700
Total Estimated Cost			
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	4,000	4,000	4,000
FY 2021	2,500	2,500	2,000
FY 2022	700	700	1,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2023	14,900	14,900	6,800
FY 2024	2,700	2,700	11,000
FY 2025	0	0	0
FY 2026	0	0	0
FY 2027	0	0	0
FY 2028	0	0	0
FY 2029	0	0	0
FY 2030	0	0	0
FY 2031	0	0	0
Total, TEC	24,800	24,800	24,800
Other Project Cost (OPC)			
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	1,000	1,000	1,000
FY 2025	4,500	4,500	4,500
FY 2026	0	0	0
FY 2027	0	0	0
FY 2028	0	0	0
FY 2029	0	0	0
FY 2030	0	0	0
FY 2031	0	0	0
Total, OPC	5,500	5,500	5,500
Total Project Cost (TPC)			
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	4,000	4,000	4,000
FY 2021	2,500	2,500	2,000
FY 2022	700	700	1,000
FY 2023	14,900	14,900	6,800

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	3,700	3,700	12,000
FY 2025	4,500	4,500	4,500
FY 2026	0	0	0
FY 2027	0	0	0
FY 2028	0	0	0
FY 2029	0	0	0
FY 2030	0	0	0
FY 2031	0	0	0
Total, TPC (18-D-650-01)	30,300	30,300	30,300

Process Buildings Subproject (18-D-650-02)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	23,000	23,000	7,500
FY 2021	24,500	24,500	22,000
FY 2022	26,300	26,300	41,800
FY 2023	58,400	58,400	58,400
FY 2024	10,000	10,000	12,500
FY 2025	0	0	0
FY 2026	0	0	0
FY 2027	0	0	0
FY 2028	0	0	0
FY 2029	0	0	0
FY 2030	0	0	0
FY 2031	0	0	0
Total, Design	142,200	142,200	142,200
Construction			
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	79,500	79,500	73,000
FY 2025	105,700	105,700	96,000
FY 2026	89,200	89,200	85,000
FY 2027	66,200	66,200	60,000
FY 2028	42,700	42,700	42,300
FY 2029	12,000	12,000	22,000
FY 2030	0	0	12,300
FY 2031	0	0	4,700
Total, Construction	395,300	395,300	395,300
Total Estimated Cost			
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	23,000	23,000	7,500
FY 2021	24,500	24,500	22,000
FY 2022	26,300	26,300	41,800
FY 2023	58,400	58,400	58,400

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	89,500	89,500	85,500
FY 2025	105,700	105,700	96,000
FY 2026	89,200	89,200	85,000
FY 2027	66,200	66,200	60,000
FY 2028	42,700	42,700	42,300
FY 2029	12,000	12,000	22,000
FY 2030	0	0	12,300
FY 2031	0	0	4,700
Total, TEC	537,500	537,500	537,500
Other Project Cost (OPC)			
FY 2015	1,700	1,700	1,700
FY 2016	3,300	3,300	3,300
FY 2017	1,700	1,700	1,000
FY 2018	0	0	0
FY 2019	1,000	1,000	1,700
FY 2020	2,000	2,000	100
FY 2021	2,000	2,000	2,000
FY 2022	2,000	2,000	1,700
FY 2023	0	0	500
FY 2024	7,000	7,000	6,000
FY 2025	6,000	6,000	5,300
FY 2026	11,000	11,000	10,000
FY 2027	10,000	10,000	10,000
FY 2028	13,000	13,000	11,000
FY 2029	11,500	11,500	10,400
FY 2030	0	0	6,000
FY 2031	0	0	1,500
Total, OPC	72,200	72,200	72,200
Total Project Cost (TPC)			

	Budget Authority (Appropriations)	Obligations	Costs
FY 2015	1,700	1,700	1,700
FY 2016	3,300	3,300	3,300
FY 2017	1,700	1,700	1,000
FY 2018	0	0	0
FY 2019	1,000	1,000	1,700
FY 2020	25,000	25,000	7,600
FY 2021	26,500	26,500	24,000
FY 2022	28,300	28,300	43,500
FY 2023	58,400	58,400	58,900
FY 2024	96,500	96,500	91,500
FY 2025	111,700	111,700	101,300
FY 2026	100,200	100,200	95,000
FY 2027	76,200	76,200	70,000
FY 2028	55,700	55,700	53,300
FY 2029	23,500	23,500	32,400
FY 2030	0	0	18,300
FY 2031	0	0	6,200
Total, TPC (18-D-650-02)	609,700	609,700	609,700

Overall Project (18-D-650)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	27,000	27,000	11,500
FY 2021	27,000	27,000	24,000
FY 2022	27,000	27,000	42,800
FY 2023	59,300	59,300	59,500
FY 2024	10,000	10,000	12,500
Total, Design	150,300	150,300	150,300
Construction			
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	14,000	14,000	5,700
FY 2024	82,200	82,200	84,000
FY 2025	105,700	105,700	96,000
FY 2026	89,200	89,200	85,000
FY 2027	66,200	66,200	60,000
FY 2028	42,700	42,700	42,300
FY 2029	12,000	12,000	22,000
FY 2030	0	0	12,300
FY 2031	0	0	4,700
Total, Construction	412,000	412,000	412,000
Total Estimated Cost			
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	27,000	27,000	11,500
FY 2021	27,000	27,000	24,000
FY 2022	27,000	27,000	42,800
FY 2023	73,300	73,300	65,200
FY 2024	92,200	92,200	96,500
FY 2025	105,700	105,700	96,000
FY 2026	89,200	89,200	85,000
FY 2027	66,200	66,200	60,000
FY 2028	42,700	42,700	42,300
FY 2029	12,000	12,000	22,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2030	0	0	12,300
FY 2031	0	0	4,700
Total, TEC	562,300	562,300	562,300
Other Project Cost (OPC)			
FY 2015	1,700	1,700	1,700
FY 2016	3,300	3,300	3,300
FY 2017	1,700	1,700	1,000
FY 2018	0	0	0
FY 2019	1,000	1,000	1,700
FY 2020	2,000	2,000	100
FY 2021	2,000	2,000	2,000
FY 2022	2,000	2,000	1,700
FY 2023	0	0	500
FY 2024	8,000	8,000	7,000
FY 2025	10,500	10,500	9,800
FY 2026	11,000	11,000	10,000
FY 2027	10,000	10,000	10,000
FY 2028	13,000	13,000	11,000
FY 2029	11,500	11,500	10,400
FY 2030	0	0	6,000
FY 2031	0	0	1,500
Total, OPC	77,700	77,700	77,700

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2015	1,700	1,700	1,700
FY 2016	3,300	3,300	3,300
FY 2017	1,700	1,700	1,000
FY 2018	0	0	0
FY 2019	1,000	1,000	1,700
FY 2020	29,000	29,000	11,600
FY 2021	29,000	29,000	26,000
FY 2022	29,000	29,000	44,500
FY 2023	73,300	73,300	65,700
FY 2024	100,200	100,200	103,500
FY 2025	116,200	116,200	105,800
FY 2026	100,200	100,200	95,000
FY 2027	76,200	76,200	70,000
FY 2028	55,700	55,700	53,300
FY 2029	23,500	23,500	32,400
FY 2030	0	0	18,300
FY 2031	0	0	6,200
Total, TPC (18-D-650)	640,000	640,000	640,000

4. Details of Project Cost Estimate

TFF costs roll up from the Site Preparation & Warehouse Construction (18-D-650-01) and Process Buildings Subprojects (18-D-650-02) to the cumulative Overall Project (18-D-650) Total Project Cost, as shown below.

Site Preparation & Warehouse Construction Subproject (18-D-650-01)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	6,500	6,500	N/A
Safety Basis	100	100	N/A
Federal Support	500	500	N/A
Project and Design Management	500	500	N/A
Contingency	500	500	N/A
Total, Design	8,100	8,100	N/A
Construction			
Site Work	8,500	8,500	N/A

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Facility Demolition	3,000	3,000	N/A
Construction	2,000	2,000	N/A
Safety Basis Documents	200	200	N/A
Federal Support	1,000	1,000	N/A
M&O Support	500	500	N/A
Contingency	1,500	1,500	N/A
Total, Construction	16,700	16,700	N/A
Total Estimated Cost	24,800	24,800	N/A
Contingency, TEC	2,000	2,000	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	0	0	N/A
Analysis of Alternative	0	0	N/A
Conceptual Design	1,000	1,000	N/A
NEPA & Permit	0	0	N/A
Federal Support	250	250	N/A
Safeguard & Security	250	250	N/A
ES&H	2,000	2,000	N/A
Contractor Support	1,500	1,500	N/A
Startup	0	0	N/A
Contingency	500	500	N/A
Total, OPC except D&D	**5,500**	**5,500**	**N/A**
Contingency, OPC	500	500	N/A
Total Project Cost (18-D-650-01)	30,300	30,300	N/A
Total Contingency (TEC +OPC)	2,500	2,500	N/A

Process Buildings Subproject (18-D-650-02)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous [a] Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	99,400	95,000	N/A
Safety Basis	8,300	7,900	N/A
Federal Support	5,700	5,500	N/A
Project and Design Management	12,600	12,000	N/A
Contingency	16,200	15,500	N/A
Total, Design	142,200	135,900	N/A
Construction			
Site Work	3,900	4,000	N/A
Facility Demolition	1,000	1,000	N/A
Construction	328,600	333,800	N/A
Safety Basis Documents	5,700	5,800	N/A
Federal Support	6,900	7,000	N/A
M&O Support	4,400	4,500	N/A
Contingency	44,800	45,500	N/A
Total, Construction	395,300	401,600	N/A
Total Estimated Cost	**537,500**	**537,500**	**N/A**
Contingency, TEC	61,000	61,000	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	3,700	3,700	N/A
Analysis of Alternative	800	800	N/A
Conceptual Design	2,200	2,200	N/A
NEPA & Permit	500	500	N/A
Federal Support	2,750	2,750	N/A
Safeguard & Security	750	750	N/A
ES&H	10,500	10,500	N/A
Contractor Support	4,500	4,500	N/A
Startup	38,000	38,000	N/A
Contingency	8,500	8,500	N/A

[a] Totals for Design and Construction under the Previous Total Estimate were mis-added in FY22 PDS. Adjustments to Current Total Estimate values now add to totals appropriately.

	Current Total Estimate	Previous [a] Total Estimate	Original Validated Baseline
Total, OPC except D&D	**72,200**	**72,200**	**N/A**
Contingency, OPC	8,500	8,500	N/A
Total Project Cost (18-D-650-02)	**609,700**	**609,700**	**N/A**
Total Contingency (TEC+OPC)	**69,500**	**69,500**	**N/A**

Overall Project (18-D-650)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous[a] Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	105,900	101,500	N/A
Safety Basis	8,400	8,000	N/A
Federal Support	6,200	6,000	N/A
Project and Design Management	13,100	12,500	N/A
Contingency	16,700	16,000	N/A
Total, Design	150,300	144,000	N/A
Construction			
Site Work	12,400	12,500	N/A
Facility Demolition	4,000	4,000	N/A
Construction	330,600	335,800	N/A
Safety Basis Documents	5,900	6,000	N/A
Federal Support	7,900	8,000	N/A
M&O Support	4,900	5,000	N/A
Contingency	46,300	47,000	N/A
Total, Construction	412,000	418,300	N/A
Total Estimated Cost	562,300	562,300	N/A
Contingency, TEC	63,000	63,000	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	3,700	3,700	N/A
Analysis of Alternative	800	800	N/A
Conceptual Design	3,200	3,200	N/A
NEPA & Permit	500	500	N/A
Federal Support	3,000	3,000	N/A
Safeguard & Security	1,000	1,000	N/A
ES&H	12,500	12,500	N/A
Contractor Support	6,000	6,000	N/A
Startup	38,000	38,000	N/A

[a] Totals for Design and Construction under the Previous Total Estimate were mis-added in FY22 PDS. Adjustments to Current Total Estimate values now add to totals appropriately.

Contingency	9,000	9,000	N/A
Total, OPC except D&D	**77,700**	**77,700**	**N/A**
Contingency, OPC	9,000	9,000	N/A
Total Project Cost (18-D-650)	640,000	640,000	N/A
Total Contingency (TEC+OPC)	72,000	72,000	N/A

5. Schedule of Appropriations Requests

TFF funding is appropriated, apportioned and allocated at the Overall Project level (18-D-650), then distributed within the Overall Project to the subprojects, as shown in previous Sections of this Project Data Sheet.

Overall Project (18-D-650)

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Out Years	Total
FY 2018[a]	TEC	81,805	13,000	22,000	N/A	N/A	N/A	N/A	N/A	308,195	425,000
	OPC	16,100	3,000	3,000	N/A	N/A	N/A	N/A	N/A	51,900	74,000
	TPC	97,905	16,000	25,000	N/A	N/A	N/A	N/A	N/A	360,095	499,000
FY 2019	TEC	60,800	13,000	30,000	45,000	200,000	152,242	0	0	0	501,042
	OPC	16,100	3,000	3,000	3,000	3,000	3,000	10,000	10,000	22,900	74,000
	TPC	76,900	16,000	33,000	48,000	203,000	155,242	10,000	10,000	22,900	575,042
FY 2020	TEC	27,000	13,000	30,000	44,909	166,500	152,242	110,178	0	0	543,829
	OPC	12,600	2,000	2,000	3,000	3,000	3,000	5,000	7,000	37,400	75,000
	TPC	39,600	15,000	32,000	47,909	169,500	155,242	115,178	7,000	37,400	618,829
FY 2021	TEC	27,000	27,000	27,000	55,000	85,000	120,000	97,000	73,000	51,300	562,300
	OPC	9,700	2,000	2,000	3,000	3,000	6,000	10,000	8,000	34,000	77,700
	TPC	36,700	29,000	29,000	58,000	88,000	126,000	107,000	81,000	85,300	640,000
FY 2022	TEC	27,000	27,000	27,000	TBD	TBD	TBD	TBD	TBD	481,300	562,300
	OPC	9,700	2,000	2,000	TBD	TBD	TBD	TBD	TBD	64,000	77,700
	TPC	36,700	29,000	29,000	TBD	TBD	TBD	TBD	TBD	545,300	640,000
FY 2023	TEC	27,000	27,000	27,000	73,300	92,200	105,700	89,200	66,200	54,700	562,300
	OPC	9,700	2,000	2,000	0	8,000	10,500	11,000	10,000	24,500	77,700
	TPC	36,700	29,000	29,000	73,300	100,200	116,200	100,200	76,200	79,200	640,000

6. Related Operations and Maintenance Funding Requirements

[a] For value shown in the Total Beyond FY 2027 column for the FY 2018 Request Year CPDS reflects the total representing years beyond FY 2023 found in the Outyears column of the FY 2018 CPDS.

Start of Operation or Beneficial Occupancy	4Q FY 2031
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset [Note: D&D of a tritium facility cannot begin until approximately 70 years after the end of its 50-year useful life due to tritium trapped within metallic structures that needs to decay over a period of roughly five half-lives.]	1Q FY 2152

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	4.9	4.9	2,478	2,478

7. D&D Information

Because the existing facility contains tritium, the facility cannot be decommissioned and demolished for another 70 years. The approximate area of warehouses to be demolished under 18-D-650-01 to clear the site for the new building is listed here.

D&D Description	Square Feet
1. New area being constructed by this project on the Savannah River Site	30,000 – 40,000
2. Area on the Savannah River Site to be D&D by this project (Demolished warehouses. HAOM will not undergo D&D under this project)	15,000
3. Area on the Savannah River Site to be transferred, sold, and/or D&D outside the project including area previously "banked"	0
4. Area on other sites to be D&D by this project	0
5. Area on other sites to be transferred, sold, and/or D&D outside the project including area previously "banked"	0
6. Total area eliminated (add boxes 2, 3, 4, and 5)	15,000

Square footage numbers rounded to the next highest 1,000 sq ft.

8. Acquisition Approach

The Acquisition Strategy was approved by the Deputy Administrator for Defense Programs on December 20, 2019. Based on lessons learned on other capital asset projects executed across the complex, the recommended approach for M&O design/construction projects is to segregate capital asset projects from other operational scope. Consistent with the Deputy Secretary's September 12, 2018 memorandum, *Improving Acquisition Management,* the TFF acquisition will "maximize the use of objective performance measures that focus on outcomes which balance considerations of cost control, schedule achievement, and technical performance" and ensure fee payments are "aligned with contractual end objectives and mission accomplishment".

The existing M&O contract has been modified to incorporate a new Contract Line Item (CLIN) for NNSA Capital Asset Construction Projects. This construction CLIN includes generalized terms and conditions to allow capital asset projects to be performed using contract types such as: Cost-Plus-Incentive-Fee (CPIF), Fixed-Price- Incentive-Fee (FPIF) and Fixed-Price with Economic Price Adjustment (FP-EPA) at the Sub-CLIN level. Sub-CLINs will be negotiated separately for each NNSA project at SRS. The advantage to this CLIN/Sub-CLIN approach is that additional Sub-CLINs can be negotiated and added as other NNSA capital asset construction project needs are identified.

The Sub-CLIN established for the TFF project will include the following:

- Separate work scopes for each Critical Decision (CD).
- Separate fee types for each CD that may include a combination of Incentive and Milestone Fees related to cost and schedule performance depending on the specific project phase.

It is anticipated the M&O contractor will award competitive subcontracts for various portions of the work. During FY 2021 the M&O contractor issued a subcontract to Fluor Federal Services to perform architect/engineer design scope. Although the design and construction work will require both the architect/engineering and construction firms with AMSE NQA-1 capability; significant portions of the construction work are commercial in nature and NNSA anticipates competition from qualified firms for construction

15-D-302, TA-55 Reinvestment Project (TRP) Phase III
Los Alamos National Laboratory (LANL), Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2023 request for the TA-55 Reinvestment Project Phase III is $30,002,000 of Total Estimated Cost (TEC) funding. The TEC baseline is $188,887,000 and the Total Project Cost (TPC) baseline is $236,030,000.

Significant Changes:

The TA-55 Reinvestment Project was initiated in FY 2005 and subsequently split into three phases.

The most recent Critical Decision (CD) for the project is a combined CD-1/2/3 to approve the alternative selection, performance baseline, and authorization of construction which was approved on May 6, 2021. An Independent Cost Estimate and External Independent Review were completed in August and October 2020 respectively to support the approval of the Performance Baseline. The TPC estimate approved at CD-1/2/3 is shown below and approved by the Project Management Executive per DOE Order 413.3B. Future Years Nuclear Security Program (FYNSP) amounts contain reduced amounts of management reserve and contingency. NNSA will re-evaluate outyear funding levels as project risks are realized. FY 2023 funding will be used to continue construction. The pace at which construction and turnover to operations can be executed is limited by the work being performed in an operating nuclear facility that is required to support critical program deliverables during the execution of this project. These considerations were validated during the NNSA review and approval of the CD-1/2/3 package and are reflected in the CD-4 date which is forecasted for the 3rd quarter of FY 2027.

The Baseline is reflective of CD-1/2/3 package and consistent with the scope selection from the Federal Analysis of Alternatives (AoA), final design, lessons learned, and input from the Independent Cost Estimate and External Independent Reviews.

A Federal Project Director has been appointed to this project and has approved this data sheet.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2015	03/23/2005		1QFY2015	4QFY 2017	2QFY2018	2QFY2018	N/A	4QFY2022
FY 2016	03/23/2005	12/23/2014	4QFY2016	4QFY 2018	2QFY2018	4QFY2018	N/A	3QFY2026
FY 2017	03/23/2005	12/23/2014	4QFY2016	4QFY 2018	2QFY2018	4QFY2018	N/A	4QFY2025
FY 2021	03/23/2005	11/15/2018	3QFY2021	3QFY2021	4QFY2020	3QFY2021	2QFY2024	2QFY2026
FY 2022	03/23/2005	11/15/2018	5/06/2021	5/06/2021	1/22/2021	5/06/2021	2QFY2025	3QFY2027
FY 2023	03/23/2005	11/15/2018	5/06/2021	5/06/2021	1/22/2021	5/06/2021	2QFY2025	3QFY2027

CD-0 – Approve Mission Need
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Project Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction/Execution
D&D Complete – Completion of D&D work (see Section 9)
CD-4 – Approve Start of Operations or Project Completion

Project Cost History

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	30,062	110,000	140,062	29,500	N/A	29,500	169,562
FY 2016	30,060	150,002	180,062	46,500	N/A	46,500	226,562
FY 2017	30,060	111,448	141,508	31,500	N/A	31,500	173,008
FY 2021	35,628	155,104	190,732	34,658	12,808	47,466	238,198
FY 2022	22,435	166,452	188,887	44,778	2,365	47,143	236,030
FY 2023	19,184[a]	169,703	188,887	44,778	2,365	47,143	236,030

2. Project Scope and Justification

Scope

The TRP III scope encompasses replacing the currently outdated LANL Technical Area (TA)-55 fire alarm system that is not compliant with current codes and standards. Specifically the existing detection, control, and evacuation devices associated with the fire alarm system are not National Fire Protection Association (NFPA) or Americans with Disabilities Act (ADA) compliant, and are not Underwriters Laboratories (UL) listed. All major components of the system are obsolete and costly to maintain. Spare part availability has continued to be a significant concern as circuit boards for the main fire alarm control panel are no longer available.

The current single fire alarm control panel will be replaced with multiple panels; separating the nuclear facility, Plutonium Facility (PF)-4, and the non-nuclear facilities within the TA-55 site. The scope also includes addition of area-wide and early warning fire detection throughout PF-4, installation of Underwriter Laboratory (UL) listed digital/addressable components, sprinkler flow sensing switches, new evacuation strobes and audible alarms, consolidated monitoring of the campus in the TA-55 Operations Center, and other components to provide inputs from over 2,000 devices spread throughout 199 zones of protection in TA-55. All new systems must be installed and accepted into operation while existing systems continue to provide alarm functions for the operating facility.

Upon completion of the new system, the project includes decommissioning and decontamination of components of the old systems. Demolition involves appropriate radiation protection and waste management characterization of the areas and parts to be removed.

Justification

PF-4 within TA-55 is the only Hazard Category 2 (HC-2) nuclear facility/Security Category 1 (SC-1) supporting all enduring Plutonium missions for Department of Energy (DOE)/NNSA at this time. The mission need for TRP III is to extend the life of TA-55 so it can continue to operate safely and reliably in support of the stockpile stewardship program. This project specifically extends the life of TA-55 by recapitalizing and revitalizing an aging and obsolete fire alarm system.

The TA-55 main fire control panel and supporting devices represent a single point failure risk for this critical capability. More specifically, this facility is critical to support certification of the stockpile, pit production, and all other DOE/NNSA plutonium missions. PF-4 has been in operation for over 35 years and, before the TRP I and TRP II upgrades, the infrastructure and systems were aging and approaching the end of their service life, required excessive maintenance, and experienced increased operating costs and reduced system reliability. The facility is not in compliance with safety and regulatory requirements that are required for the fire alarm systems. TRP III is the final phase of the three-phase project that supports critical upgrades of PF-4 within the TA-55 boundary at LANL.

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[a] TEC design activities were completed for $3.251M less than the baselined value $22.435M. The budget under-run was reallocated to Federal construction contingency during the implementation of the performance baseline.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director to conduct independent assessments of the planning and execution of this project required by DOE Order 413.3B and to conduct technical reviews of design and construction documents.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Key Performance Parameters (KPPs)

The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure[a]	Threshold KPP	Objective KPP
New PF-4 fire alarm system (FAS)	**T1:** New FAS is installed and accepted into operations for PF-4	**O1:** New FAS is installed and accepted into operations for Balance of Plant
	T2: All data points cutover from old system to the new system as required per baseline design	**O2:** All Balance of Plant data points cutover from old system to the new system as required per baseline design

3. Financial Schedule

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2015	16,062	16,062	0
FY 2016[b]	6,373	8,192	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	1,503
FY 2020[b]	0	(1,819)	12,506
FY 2021	(3,251)[c]	(3,251)	5,175[d]
FY 2022	0	0	0
Total Design	19,184	19,184	19,184
Construction			
FY 2016	10,003	10,003	0

[a] Key Performance Parameters approved per CD-1/2/3.

[b] In FY 2020 there was reprogramming of $1.82M of the FY 2016 appropriation to the LANL TA-3 Substation replacement, 16-D-621.

[c] TEC design activities were completed for $3.251M less than the baselined value $22.435M. The budget under-run was reallocated to contingency per the performance baseline.

[d] Final design financial closeout was completed in the first quarter of FY 2022 that resulted in a cost reduction of $19K. This reduction was applied against the FY 2021 costs.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2017	2,000	2,000	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	33,251[a]	33,251	7,762
FY 2022	27,000	27,000	54,976
FY 2023	30,002	30,002	39,261
FY 2024	30,000	30,000	27,623
FY 2025	34,474	34,474	37,108
FY 2026	2,000	2,000	2,000
Total Construction	168,730	168,730	168,730
Total Estimated Costs (TEC)			
FY 2015	16,062	16,062	0
FY 2016[b]	16,376	18,195	0
FY 2017	2,000	2,000	0
FY 2018	0	0	0
FY 2019	0	0	1,503
FY 2020	0	(1,819)	12,506
FY 2021	30,000	30,000	12,937
FY 2022	27,000	27,000	54,976
FY 2023	30,002	30,002	39,261
FY 2024	30,000	30,000	27,623
FY 2025	34,474	34,474	37,108
FY 2026	2,000	2,000	2,000
Total TEC	**187,914[c]**	**187,914**	**187,914**
Other Project Costs (OPC)			
OPC except D&D			
FY 2013[d]	1,675	1,675	1,675
FY 2014	750	750	750
FY 2015	1,802	1,802	1,802
FY 2016	133	133	133
FY 2017	828	828	828

[a] TEC reflected appropriation of $30M plus funding reallocated at the completion of design - $3.251M.
[b] In FY 2020 there was reprogramming of $1.82M of the FY 2016 appropriation to the LANL TA-3 Substation replacement, 16-D-621.
[c] The total funding amount and the total spend plan do not match. The funding level in the financial schedule is provided at a 70% confidence level while the approved top of the cost range is provided at an 85% confidence level.
[d] The OPC costs for FY 2013 through FY 2019 have been updated to reflect the actual cost incurred.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2018	3,596	3,596	3,596
FY 2019	1,804	1,804	1,775
FY 2020[a]	500	500	-6
FY 2021	2,000	2,000	174
FY 2022	5,000	5,000	6,582
FY 2023	10,900	10,900	10,037
FY 2024	9,543	9,543	8,258
FY 2025	5,700	5,700	8,215
FY 2026	547	547	959
Total, OPC except D&D	44,778	44,778	44,778
OPC D&D			
FY 2023	100	100	79
FY 2024	2,265	2,265	2,286
Total OPC D&D	2,365	2,365	2,365
Total OPC			
FY 2013[b]	1,675	1,675	1,675
FY 2014	750	750	750
FY 2015	1,802	1,802	1,802
FY 2016	133	133	133
FY 2017	828	828	828
FY 2018	3,596	3,596	3,596
FY 2019	1,804	1,804	1,775
FY 2020	500	500	-6
FY 2021	2,000	2,000	174
FY 2022	5,000	5,000	6,582
FY 2023	11,000	11,000	10,116
FY 2024	11,808	11,808	10,544
FY 2025	5,700	5,700	8,215
FY 2026	547	547	959
Total OPC	**47,143**	**47,143**	**47,143**
Total Project Costs (TPC)			
FY 2013	1,675	1,675	1,675
FY 2014	750	750	750
FY 2015	17,864	17,864	1,802
FY 2016	16,509	18,328	133
FY 2017	2,828	2,828	828

[a] No OPC funding was provided in FY 2020. The required OPCs were added in FY 2022.
[b] The OPC costs for FY 2013 through FY 2019 have been updated to reflect the actual cost incurred.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2018	3,596	3,596	3,596
FY 2019	1,804	1,804	3,278
FY 2020	500	(1,319)	12,500
FY 2021	32,000	32,000	13,111
FY 2022	32,000	32,000	61,558
FY 2023	41,002	41,002	49,377
FY 2024	41,808	41,808	38,167
FY 2025	40,174	40,174	45,323
FY 2026	2,547	2,547	2,959
Grand Total TPC	**235,057**[a]	**235,057**	**235,057**

[a] Due to a management decision during the budgeting process, the total funding amount and the total spend plan do not match. The funding level in the financial schedule is provided at a 70% confidence level while the approved top of the cost range is provided at an 85% confidence level.

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	18,884	22,135	22,135
Federal Support	300	300	300
Contingency			
Total, Design	19,184	22,435	22,435
Construction			
Long Lead Procurements	0	0	0
Construction	111,499	111,499	111,499
Safety Basis			
Federal Support	5,239	5,239	5,239
Contingency	52,965	49,714	49,714
Total, Construction	169,703	166,452	166,452
Total, TEC	188,887	188,887	188,887
Contingency, TEC	52,965[a]	49,714	49,714
Other Project Cost (OPC)			
OPC except D&D	0	0	0
Conceptual Planning	8,885	8,885	8,885
Conceptual Design	1,668	1,668	1,668
Start-Up	9,405	9,405	9,405
Project Support	14,541	14,541	14,541
Federal Support	1,160	1,160	1,160
Contingency	9,119	9,119	9,119
Total OPC except D&D	44,778	44,778	44,778
OPC D&D			
OPC D&D	2,365	2,365	2,365
Contingency			
Total OPC D&D	2,365	2,365	2,365

[a] TEC design activities were completed for $3.251M less than the baselined value $22.435M. The budget under-run was reallocated to Federal construction contingency during the implementation of the performance baseline.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total, OPC	**47,143**	**47,143**	**47,143**
Contingency, OPC	9,119	9,119	9,119
Total, TPC	**236,030[a]**	**236,030**	**236,030**
Total, Contingency	**62,084**	**58,833**	**58,833**

5. Schedule of Appropriation Requests[b]

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Outyears	Total
FY 2015	TEC	140,062	0	0	0	0	0	0	0	0	140,062
	OPC	26,500	2,000	1,000	0	0	0	0	0	0	29,500
	TPC	166,562	2,000	1,000	0	0	0	0	0	0	169,562
FY 2016	TEC	109,508	30,554	20,000	15,000	5,000	0	0	0	0	180,062
	OPC	22,500	3,000	3,000	3,000	5,000	6,000	4,000	0	0	46,500
	TPC	132,008	33,554	23,000	18,000	10,000	6,000	4,000	0	0	226,562
FY 2017	TEC	109,508	0	32,000	0	0	0	0	0	0	141,508
	OPC	20,500	3,000	3,000	3,000	2,000	0	0	0	0	31,500
	TPC	130,008	3,000	35,000	3,000	2,000	0	0	0	0	173,008
FY 2021	TEC	36,257	30,000	30,000	30,000	30,000	34,475	0	0	0	190,732
	OPC	12,588	2,000	3,000	11,000	11,808	4,000	3,070	0	0	47,466
	TPC	48,845	32,000	33,000	41,000	41,808	38,475	3,070	0	0	238,198
FY 2022	TEC	34,437[c]	30,000	27,000	TBD	TBD	TBD	TBD	TBD	97,450	188,887
	OPC	11,088	2,000	5,000	TBD	TBD	TBD	TBD	TBD	29,055	47,143
	TPC	45,525	32,000	32,000	TBD	TBD	TBD	TBD	TBD	126,505	236,030
FY 2023	TEC	34,438	30,000	27,000	30,002	30,000	34,474	2,000	0	0	187,914
	OPC	11,088	2,000	5,000	11,000	11,808	5,700	547	0	0	47,143
	TPC	45,526	32,000	32,000	41,002	41,808	40,174	2,547	0	0	235,057[a]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	3Q FY 2027
Expected Useful Life (number of years)	25 years
Expected Future Start of D&D of this capital asset (fiscal quarter)	3Q FY 2052

[a] Section 4 estimate remains consistent with CD-1/2/3 performance baseline. Due to a management decision during the budgeting process, the total funding amount and the total spend plan do not match. The funding level in the financial schedule is provided at a 70% confidence level while the approved performance baseline is provided at an 85% confidence level.

[b] Entries in this table have been updated to correct errors in prior year appropriation request amounts shown in the FY 2022 Construction Project Data Sheet

[c] The decrease in the prior year TEC funding is the result of an FY 2020 reprogramming of $1.82M of the FY 2016 appropriation to the LANL TA-3 Substation replacement 16-D-621.

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	**Current Total Estimate**	**Previous Total Estimate**	**Current Total Estimate**
Operations and Maintenance	N/A	N/A	N/A	N/A

7. D&D Information

There is no new area being constructed in this construction project, but the old system will be removed.

8. Acquisition Approach

The TRP III acquisition strategy assigns project execution to the LANL Management and Operating (M&O) Contractor. The final design was issued through a firm fixed price subcontract. Construction activities will be self-performed by the M&O Contractor for PF-4 scope and can be subcontracted for the Balance of Plant scope.

07-D-220-04 Transuranic Liquid Waste (TLW) Treatment Facility Upgrade Project,
Los Alamos National Laboratory (LANL), Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary:
Critical Decision (CD) 2/3 was approved on January 6, 2022 with a Total Estimated Cost (TEC) of $193,228,000, and the Total Project Cost (TPC) baseline is $215,327,000 and a CD-4 Approval date of August 29, 2027. The FY23 request is $4,000,000 OPC, $24,759,000 TEC and $28,759,000 TPC.

Significant Changes:
This Construction Project Data Sheet (CPDS) is an update of the Fiscal Year (FY) 2021 CPDS and does not include a new start for the budget year. The most recent critical decision is CD-2/3, Approve Performance Baseline and Start of Construction on January 6, 2022 with a TPC of $215,327,000 and a CD-4 date of August 2027. The Project completed the final design in September 2017 and the Preliminary Documented Safety Analysis was approved in April 2018. As required by the Department of Energy Order (DOE O) 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, prior to CD-2/3 approval the DOE Office of Project Management Oversight and Assessment (PMOA) conducted the Independent Cost Estimate (ICE) in February 2018. Based on this estimate, the upper end of the TPC range was estimated at $144,000,000 with a CD-4 date of 4Q FY 2024. The Project was paused in September 2017 to allow the upcoming Management and Operating contractor to accept the ownership of the design and nuclear safety basis. The project was authorized to restart in 2019. In May 2019, a new architect/engineer (A/E) evaluated the existing design; this A/E will become the engineer of record (EOR) who accepts responsibility and liability of the design. The project design was revised to address changes to DOE Orders, Standards, and design operability concerns.

DOE-PM updated the ICE and conducted the required External Independent Review (EIR) to validate the Performance Baseline in FY 2021. The construction RFP was issued April 21, 2021 and bids were received July 23, 2021. The bids that were received significantly exceeded the performance baseline estimate. The cost increases are attributed to current market conditions associated with an increase of regional construction projects absorbing all the construction capacity, increases in commodity prices, and the impacts from COVID-19. CD-2/3 was approved with a Total Project Cost (TPC) baseline of $215,327,000 and a CD-4 Approval date of August 29, 2027. The construction sub contract was awarded on March, 23, 2022.

A Level 3 Federal Project Director has been appointed.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2014	10/04/2004		09/16/2011	4QFY 2016	1QFY 2017	1Q FY 2017	N/A	4Q FY 2020
FY 2015	10/04/2004		09/23/2013	4QFY 2016	1QFY 2017	2Q FY 2017	N/A	4Q FY 2020
FY 2016	10/04/2004	09/23/2013	09/23/2013	4QFY 2017	1QFY 2017	4Q FY 2017	N/A	4Q FY 2020
FY 2017	10/04/2004	09/23/2013	09/23/2013	4Q FY 2017	1Q FY 2017	4Q FY 2017	N/A	4Q FY 2021
FY 2018	10/04/2004	09/23/2013	09/23/2013	2Q FY 2018	02/06/2017	2Q FY 2018	N/A	4Q FY 2023
FY 2021	10/04/2004	09/23/2013	09/23/2013	4Q FY 2020	1Q FY 2021	4Q FY 2020	N/A	4Q FY 2024
FY 2023	10/04/2004	09/23/2013	09/23/2013	01/06/2022	04/15/2021	01/06/2022	N/A	4Q FY 2027

CD-0 – Approve Mission Need
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Project Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction/Execution
D&D Complete – Completion of D&D work (see Section 9)
CD-4 – Approve Start of Operations or Project Completion

Project Cost History

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2014	20,546	74,270	94,816	12,780	0	12,780	107,596
FY 2015	25,605	60,000	85,605	10,428	0	10,428	96,033
FY 2016	25,605	66,997	92,602	10,428	0	10,428	103,030
FY 2017	25,605	66,997	92,602	10,428	0	10,428	103,030
FY 2018	25,605	67,244	92,849	12,940	0	12,940	105,789
FY 2021	40,500	89,036	129,536	14,464	0	14,464	144,000
FY 2023	44,829	148,399	193,228	22,099	0	22,099	215,327

2. Project Scope and Justification

Scope
The project will design and construct a new hazard category 3 nuclear facility of approximately 5,000 square feet. The facility will house processing equipment capable of treating at least 29,000 liters of transuranic (TRU) liquid waste each year, a TRU liquid influent storage and necessary utilities.

Justification
The existing degraded and outdated treatment facility systems pose elevated risk to workers, public, environment and plutonium missions at LANL. Continuous workarounds are required to keep systems running and excessive corrosion threatens system availability. The replacement is needed to remediate significant deficiencies associated with the existing Radioactive Liquid Waste (RLW) treatment capabilities that pose a threat to the long-term availability of this function. The replacement is ultimately aimed at providing a RLW treatment capability that is safe, reliable, and effective for the next 50 years in support of primary plutonium missions at LANL. Delays in TLW could have a significant risk to the NNSA plutonium mission due to the potential risks associated with the aging existing Radioactive Liquid Waste Treatment Facility. The new facility will be built to comply with the current codes, Nuclear Safety/Quality, standards including International Building Code, seismic design/construction codes, and the National Electric Code (NEC).

The project is being executed in accordance with the project management requirements in DOE Order 413.3B. Funds appropriated under this data sheet may be used to for independent assessments of the planning and execution of this project and for contracted support services to the federal project team for oversight and support.

Key Performance Parameters (KPPs)
The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Key Performance Parameters (KPPs)

Performance Measure	Threshold KPP	Objective KPP
- Design and construct the capability to process 29,000 liters per year of TRU liquid waste - Design and construct the TLW Facility such that the TLW effluent will meet the Waste Acceptance Criteria (WAC) for the LLW collection system	- Process 29,000 liters per year - Meet the WAC for the LLW collection system	Any additional throughput will be accomplished through operational tempo since this facility is a batch process expected

3. Financial Schedule

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2014	10,605	10,605	641
FY 2015	7,500	7,450	4,471
FY 2016	22,395	22,437	8,474
FY 2017	0	8	7,390
FY 2018	0	0	0
FY 2019	0	0	780
FY 2020	0	0	12,006
FY 2021	4,329	4,329	9,799
FY 2022	0	0	1,268
FY 2023	0	0	0
FY 2024	0	0	0
Total Design	44,829	44,829	44,829
Construction			
FY 2016	18,554	18,554	0
FY 2017	15,900	15,900	0
FY 2018	17,895	17,895	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	32,358	0	0
FY 2022	30,000	62,358	78,005
FY 2023	24,759	24,759	22,249
FY 2024	8,933	8,933	48,145
Total Construction	148,399	148,399	148,399

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Costs (TEC)			
FY 2014	10,605	10,605	641
FY 2015	7,500	7,450	4,471
FY 2016	40,949	40,991	8,474
FY 2017	15,900[a]	15,908	7,390
FY 2018	17,895	17,895	0
FY 2019	0	0	780
FY 2020	0	0	12,006
FY 2021	36,687	4,329	9,799
FY 2022	30,000	62,358	79,273
FY 2023	24,759	24,759	22,249
FY 2024	8,933	8,933	48,145
Total TEC	**193,228**	**193,228**	**193,228**
Other Project Costs (OPC)			
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	524	524	0
FY 2019	1,000	1,000	1,426
FY 2020	1,710	1,710	121
FY 2021	1,000	1,000	0
FY 2022	3,000	3,000	692
FY 2023	4,000	4,000	2,825
FY 2024	6,230	6,230	12,400
FY 2025	4,635	4,635	4,635
Total OPC	**22,099**	**22,099**	**22,099**
Total Project Costs (TPC)			
FY 2014	10,605	10,605	641
FY 2015	7,500	7,450	4,471
FY 2016	40,949	40,991	8,474
FY 2017	15,900	15,908	7,390
FY 2018	18,419	18,419	0
FY 2019	1,000	1,000	2,206
FY 2020	1,710	1,710	12,127
FY 2021	37,687	5,329	9,799

[a] FY 2017 amount reflects a reprogramming of $1,153,000 from this project to the Radioactive Liquid Waste Treatment Facility project.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	33,000	65,358	79,965
FY 2023	28,759	28,759	25,074
FY 2024	15,163	15,163	60,545
FY 2025	4,635	4,635	4,635
Grand Total TPC	**215,327**	**215,327**	**215,327**

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	44,711	27,500	44,711
Federal Support	0	2,200	0
Contingency	118,400	10,800	118,400
Total, Design	44,829	40,500	44,829
Construction			
Other Construction	112,150	51,259	112,150
Equipment (GFE)	0	8,191	0
Safety Basis	2,421	6,994	2,421
Federal Support	5,275	3,000	5,275
Contingency	28,553	19,592	28,553
Total, Construction	148,399	89,036	148,399
Total, TEC	**193,227**	**129,536**	**193,227**
Contingency, TEC	28,671	30,392	28,671
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	0	0	0
Conceptual Design			
Design Support	1,547	3,565	1,547
Start-Up	15,904	5,537	15,904
Federal Support	725	0	725
Contingency	3,923	5,362	3,923
Total OPC except D&D	22,099	14,464	22,099
OPC D&D			
OPC D&D	0	0	0
Contingency	0	0	0
Total OPC D&D	0	0	0

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total, OPC	**22,099**	**14,464**	**22,099**
Contingency, OPC	3,923	5,362	3,923
Total, TPC	**215,327**	**144,000**	**215,327**
Total, Contingency	**32,595**	**35,754**	**32,595**

5. Schedule of Appropriation Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	Total
FY2014	TEC	86,053	0	0	0	0	0	86,053
	OPC	12,780	0	0	0	0	0	12,780
	TPC	98,833	0	0	0	0	0	98,833
FY2015	TEC	85,605	0	0	0	0	0	85,605
	OPC	10,428	0	0	0	0	0	10,428
	TPC	96,033	0	0	0	0	0	96,033
FY2016	TEC	85,102	0	0	0	0	0	85,102
	OPC	10,428	0	0	0	0	0	10,428
	TPC	95,530	0	0	0	0	0	95,530
FY2017	TEC	85,102	0	0	0	0	0	85,102
	OPC	9,428	1,000	0	0	0	0	10,428
	TPC	94,530	1,000	0	0	0	0	95,530
FY2018	TEC	92,849	0	0	0	0	0	92,849
	OPC	4,234	1,000	2,000	512	0	0	7,746
	TPC	97,083	1,000	2000	512	0	0	100,595
FY2021	TEC	92,849	36,687	0	0	0	0	129,536
	OPC	3,234	1,000	3,000	4,000	3230	0	14,464
	TPC	96,083	37,687	3000	4000	3230	0	144,000
FY2023	TEC	92,849	36,687	30,000	24,759	8,933	0	193,228
	OPC	3,234	1,000	3,000	4,000	6,230	4,635	22,099
	TPC	96,083	37,687	33,000	28,759	15,163	4,635	215,327

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	Q4 FY 2027
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	Q4 FY 2077

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Current Total Estimate	Previous Total Estimate	Current Total Estimate	Previous Total Estimate
Operations	1.400	1.400	70.0	70.0
Utilities	.050	.050	2.5	2.5
Maintenance & Repair	.400	.400	20.0	20.0
Total	1.850	1.850	92.5	92.5

7. D&D Information

The one-for-one offset requirement will be met by utilizing site-banked square footage. A plan for D&D of the existing facility will be developed at the end of construction of the new facility when characterization data is available.

	Square Feet
New area being constructed by this project at LANL	5,000
Area of D&D in this project at LANL	0
Area at LANL to be transferred, sold, and/or D&D outside the project including area previously “banked”	5,000
Area of D&D in this project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the project including area previously “banked”	0
Total area eliminated	5,000

8. Acquisition Approach

CD-2/3 approval was received on January 6, 2022, and a firm fixed price contract for construction was awarded on March, 23, 2022.

Uranium Processing Facility (UPF), 06-D-141
Y-12 National Security Complex, Oak Ridge, Tennessee
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

<u>**Summary:**</u>

The FY 2023 Request for the Uranium Processing Facility (UPF) is $362,000,000. The current Critical Decision (CD)-2/3 was approved on March 21, 2018 by the Deputy Secretary of Energy, with a total project cost (TPC) of $6,500,000,000 and a CD-4 of December 31, 2025. A Level 4 Federal Project Director has been assigned to this project and has approved this Capital Asset Project Data Sheet (CPDS).

The project plans to allocate $70 million in FY 2023 for the Salvage and Accountability Building (SAB) Subproject (06-D-141-09). The CD-2/3 for the subproject was approved on March 21, 2018 by the Deputy Secretary of Energy with a TPC of $1,180,000,000. The long lead equipment authorized as part of MPB CD-3B for the SAB was included in the SAB TPC at CD-2/3 for the SAB.

The project plans to allocate $292,000,000 in FY 2023 for the Main Process Building (MPB) Subproject (06-D-141-04). The CD-2/3 was approved on March 21, 2018 by the Deputy Secretary of Energy with a TPC of $4,731,800,000. The CD-3A for Long Lead Procurement and Site Preparation was approved on March 30, 2016. The long lead equipment authorized as part of CD-3B for the MPB is included in the MPB TPC.

<u>**Significant Changes:**</u>
This project was initiated in FY 2006. The most recent Critical Decision was CD-2 for the UPF, approved by the Deputy Secretary of Energy on March 21, 2018, at a TPC of $6,500,000,000 and a CD-4 date of December 31, 2025.

Construction associated with the UPF project is ongoing, and the project is performing startup and commissioning activities for completed scope as appropriate. Significant construction activities completed in FY 2021 include completing the exterior walls and roof for the MPB, SAB, and the Process Support Facilities (PSF) such that all three buildings are “in the dry”, completing key MEB construction milestones to include 13.8KV conduit and building energization, the chilled water and cooling tower systems for the MEB, and completing installation of all facility grid racks, and the Standby Diesel Generator for the SAB; and delivery of the first two MPB gloveboxes Design is complete for the project.

The Mechanical Electrical Building (MEB) Subproject (06-D-141-06) baseline CD-4 date was extended to August 2022, and the TPC was increased from $284,000,000 to $310,000,000 via a Baseline Change approved by the Project Management Executive in February 2022. The increase in cost was covered by underruns on the previously completed Substation Subproject, as well as recovery of unearned fee. The extension of the MEB CD-4 date has no impact of the overall UPF project completion date.

The project is currently forecast to complete up to 8 months beyond current baseline. The project may potentially exceed the approved TPC of $6,500,000,000 due to ongoing supply chain issues and delays associated with the COVID-19 pandemic. More information will be available when an ongoing bottoms-up Estimate at Completion from the contractor is received and reviewed during FY 2023. More information will be provided in the FY 2024 Construction Project Data Sheet.

Since CD-2/3, the project is 70% complete and is 76% spent.

The UPF Project experienced direct costs impacts due to COVID, including reimbursement of the costs of paid leave associated with COVID-19 (including sick leave) for the contractor and eligible subcontractors. Additional impacts include direct costs associated with temperature checks, planning and response activities related to COVID-19, construction labor for facility cleaning, bus cleaning, and hand sanitizing stations, additional busing and additional medical support. Total direct, impacts realized through February 2022 are $24,850,000. NNSA continues to evaluate other potential impacts to include reduced productivity of craft and non-manual workers, and cost and schedule impacts to subcontracts and procurements.

FY 2023 and prior year funds will be used for ongoing construction, startup, and commissioning activities for the MPB, SAB, and PSF UPF subprojects. Subproject descriptions are included in Section 2.

A Level 4 Project Management Career Development Program (PMCDP) qualified Federal Project Director (FPD) has been assigned to this project and has approved this CPDS.

A FPD has been assigned to each subproject. Project funds may be used by the FPD for contracted support services for the federal project team.

As represented since the FY 2012 Request, design, construction, and Other Project Costs (OPC) will continue to be executed through the line-item funding. After October 1, 2011, OPC work has been and will only be performed using funding specifically appropriated by Congress for the project.

Critical Milestone History

Table 1: Uranium Processing Facility Project (06-D-141) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	12/17/2004	N/A	7/25/2007	TBD	2QFY2014	TBD	TBD	TBD
FY 2012	12/17/2004	N/A	7/25/2007	4QFY2013	2QFY2014	4QFY2013	TBD	TBD
FY 2013	12/17/2004	N/A	7/25/2007	4QFY2013	2QFY2014	4QFY2013	N/A	TBD
FY 2014	12/17/2004	N/A	6/8/2012	3QFY2014	4QFY2015	3QFY2015	N/A	TBD
FY 2015	12/17/2004	N/A	6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2016	12/17/2004	2/9/2006	6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2017	4QFY2017	4QFY2017	N/A	4QFY2025
FY 2018	12/17/2004	6/24/2015	6/8/2012	2QFY2018	4QFY2017	2QFY2018	N/A	4QFY2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	2QFY2018	8/25/2017	2QFY2018	N/A	4QFY2025
FY 2020 PB	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2021	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2022	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2023	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025

Table 1.1: Site Readiness Subproject (06-D-141-01) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2014 PB	12/17/2004	N/A	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2QFY2015
FY 2015	12/17/2004	N/A	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2QFY2015
FY 2016	12/17/2004	2/9/2006	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2QFY2015
FY 2017	12/17/2004	2/9/2006	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2/27/2015

Table 1.2: Site Infrastructure and Services Subproject (06-D-141-05) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2015	12/17/2004	N/A	7/25/2007	4QFY2014	4QFY2013	4QFY2014	N/A	4QFY2016
FY 2016	12/17/2004	2/9/2006	6/8/2012	2QFY2015	3QFY2015	2QFY2015	N/A	4QFY2016
FY 2017 PB	12/17/2004	2/9/2006	6/8/2012	3/12/2015	3/12/2015	3/12/2015	N/A	4/28/2018
FY 2018	12/17/2004	2/9/2006	6/8/2012	3/12/2015	3/12/2015	3/12/2015	N/A	4/28/2018
FY 2019	12/17/2004	2/9/2006	6/8/2012	3/12/2015	3/12/2015	3/12/2015	N/A	4/28/2018
FY 2020	12/17/2004	2/9/2006	6/8/2012	3/12/2015	3/12/2015	3/12/2015	N/A	2/28/2018

Table 1.3: Substation Subproject (06-D-141-07) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2016	4QFY2016	4QFY2016	N/A	1QFY2019
FY 2018 PB	12/17/2004	6/24/2015	6/8/2012	9/14/2016	9/30/2017	9/14/2016	N/A	6/30/2020
FY 2019	12/17/2004	6/24/2015	6/8/2012	9/14/2016	12/22/2017	9/14/2016	N/A	6/30/2020
FY 2020	12/17/2004	6/24/2015	6/8/2012	9/14/2016	12/22/2017	9/14/2016	N/A	6/30/2020
FY 2021	12/17/2004	6/24/2015	6/8/2012	9/14/2016	12/22/2017	9/14/2016	N/A	12/20/2019

Table 1.4: Mechanical Electrical Building Subproject (06-D-141-06) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	2QFY2017	4QFY2017	2QFY2017	N/A	4QFY2021
FY 2018 PB	12/17/2004	6/24/2015	6/8/2012	12/13/2016	4QFY2017	12/13/2016	N/A	1/31/2022
FY 2019	12/17/2004	6/24/2015	6/8/2012	12/13/2016	9/30/2017	12/13/2016	N/A	1/31/2022
FY 2020	12/17/2004	6/24/2015	6/8/2012	12/13/2016	9/30/2017	12/13/2016	N/A	1/31/2022
FY 2021	12/17/2004	6/24/2015	6/8/2012	12/13/2016	9/30/2017	12/13/2016	N/A	1/31/2022
FY 2022	12/17/2004	6/24/2015	6/8/2012	12/13/2016	9/30/2017	12/13/2016	N/A	1/31/2022
FY 2023	12/17/2004	6/24/2015	6/8/2012	12/13/2016	9/30/2017	12/13/2016	N/A	8/31/2022[a]

[a] Reflects BCP approved in FY 2022 extending the CD-4 date.

Table 1.5: Process Support Facilities Subproject (06-D-141-08) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	3QFY2017	3QFY2017	3QFY2017	N/A	4QFY2021
FY 2018	12/17/2004	6/24/2015	6/8/2012	2QFY2018	4QFY2017	2QFY2018	N/A	4QFY2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	2QFY2018	9/30/2017	2QFY2018	N/A	4QFY2025
FY 2020 PB	12/17/2004	6/24/2015	6/8/2012	3/16/2018	9/30/2017	3/16/2018	N/A	12/31/2025
FY 2021	12/17/2004	6/24/2015	6/8/2012	3/16/2018	9/30/2017	3/16/2018	N/A	12/31/2025
FY 2022	12/17/2004	6/24/2015	6/8/2012	3/16/2018	9/30/2017	3/16/2018	N/A	12/31/2025
FY 2023	12/17/2004	6/24/2015	6/8/2012	3/16/2018 [a]	9/30/2017	3/16/2018	N/A	12/31/2025

Table 1.6: Salvage and Accountability Building Subproject (06-D-141-09) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2017	4QFY2017	4QFY2017	N/A	4QFY2025
FY 2018	12/17/2004	6/24/2015	6/8/2012	3/21/2018	4QFY2017	3/21/2018	N/A	4QFY2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	4QFY2025
FY 2020 PB	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2021	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2022	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2023	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025

Table 1.7: Main Process Building Subproject (06-D-141-04) Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2014	12/17/2004	N/A	6/8/2012	3QFY2014	4QFY2015	3QFY2015	N/A	TBD
FY 2015	12/17/2004	N/A	6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2016	12/17/2004	2/9/2006	6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2017	4QFY2017	4QFY2017	N/A	4QFY 2025
FY 2018	12/17/2004	6/24/2015	6/8/2012	2QFY2018	4QFY2017	2QFY2018	N/A	4QFY 2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	2QFY 2018	8/25/2017	2QFY2018	N/A	4QFY 2025
FY 2020 PB	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2021	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2022	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025
FY 2023	12/17/2004	6/24/2015	6/8/2012	3/21/2018	8/25/2017	3/21/2018	N/A	12/31/2025

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

[a] Corrects CD-2/3 approval date to 3/16/2018 from FY 2020 through FY 2022 dates, which were in error.

Table 2: Uranium Processing Facility Project (06-D-141) Baseline and Long Lead Approval by Fiscal Quarter or Date

Fiscal Year	UPF CD-2/3	MPB CD-3A	MPB CD-3B	MPB CD-3C	Substation CD-3A
FY 2017	N/A	2QFY2016	1QFY2017	1QFY2017	3QFY2016
FY 2018	3/21/2018	3/30/2016	1/13/2017	N/A	N/A

MPB CD-3A – Long Lead Procurement for site preparation and long lead procurements
MPB CD-3B – Long Lead Procurements
MPB CD-3C – Cancelled as reflected in the FY 2018 CPDS
Substation CD-3A – Cancelled as reflected in the FY 2018 CPDS

Project Cost History

Table 3: Uranium Processing Facility Project (06-D-141) Financial Data
(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	351,149	935,000-1,604,000	1,124,000-1,928,000	276,000-472,000	TBD	TBD	1,400,000-3,500,000
FY 2012	528,690	3,174,779-5,320,310	3,703,000-5,849,000	497,000-651,000	N/A	497,000-651,000	4,200,000-6,500,000
FY 2013	566,192	3,136,808-5,150,808	3,703,000-5,717,000	497,000-783,000	N/A	497,000-783,000	4,200,000-6,500,000
FY 2014	1,164,000	TBD	TBD	TBD	N/A	TBD	TBD
FY 2015	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2016	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2017	1,880,000	4,103,000	5,983,000	517,000	0	517,000	6,500,000
FY 2018	1,926,000	4,148,500	6,074,500	425,500	0	425,500	6,500,000
FY 2019	1,855,809	4,463,724	6,319,533	180,467	0	180,467	6,500,000
FY 2020	1,838,000	4,283,337	6,121,337	378,663	0	378,663	6,500,000
FY 2021	1,838,000	4,283,337	6,121,337	378,663	0	378,663	6,500,000
FY 2022	1,838,000	4,283,337	6,121,337	378,663	0	378,663	6,500,000
FY 2023	1,838,000	4,283,337	6,121,337	378,663	0	378,663	6,500,000

Table 3.1: Site Readiness Subproject (06-D-141-01) Financial Data
(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	N/A	64,000	64,000	1,000	N/A	1,000	65,000
FY 2016		64,000	64,000	1,000	N/A	1,000	65,000
FY 2017	0	43,277	43,277	0	0	0	43,277
FY 2018	0	43,277	43,277	0	0	0	43,277
FY 2019	0	43,714	43,714	0	0	0	43,714

Table 3.2: Site Infrastructure and Services Subproject (06-D-141-05) Financial Data
(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	N/A	58,000	58,000	1,500	N/A	1,500	59,500
FY 2016	N/A	84,500	84,500	500	N/A	500	85,000
FY 2017	0	78,000	78,000	500	0	500	78,500
FY 2018	0	78,000	78,000	500	0	500	78,500
FY 2019	0	78,000	78,000	500	0	500	78,500
FY 2020	0	60,500	60,500	0	0	0	60,500

Table 3.3: Substation Subproject (06-D-141-07) Financial Data
(Dollars in Thousands) [a]

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	48,000	48,000	2,000	0	2,000	50,000
FY 2018	0	60,000	60,000	0	0	0	60,000
FY 2019	0	60,000	60,000	0	0	0	60,000
FY 2020	0	60,000	60,000	0	0	0	60,000
FY 2021	0	48,568	48,568	0	0	0	48,568
FY 2022	0	43,800	43,800	0	0	0	43,800

Table 3.4: Mechanical Electrical Building Subproject (06-D-141-06) Financial Data
(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	540,000	540,000	60,000	0	60,000	600,000
FY 2018	0	284,000	284,000	0	0	0	284,000
FY 2019	0	283,917	283,917	83	0	83	284,000
FY 2020	0	282,980	282,980	1,020	0	1,020	284,000
FY 2021	0	282,980	282,980	1,020	0	1,020	284,000
FY 2022	0	282,980	282,980	1,020	0	1,020	284,000
FY 2023	0	308,980	308,980	1,020	0	1,020	310,000

Table 3.5: Process Support Facilities Subproject (06-D-141-08) Financial Data
(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	55,000	55,000	5,000	0	5,000	60,000
FY 2018	0	111,000	111,000	10,000	0	10,000	121,000
FY 2019	0	116,702	116,702	4,298	0	4,298	121,000
FY 2020	0	118,000	118,000	22,000	0	22,000	140,000
FY 2021	0	118,000	118,000	22,000	0	22,000	140,000
FY 2022	0	118,000	118,000	22,000	0	22,000	140,000
FY 2023	0	118,000	118,000	22,000	0	22,000	140,000

[a] Includes $16,200K of savings from the Substation Subproject which has been redeployed to cover a TPC increase in the MEB Subproject.

Table 3.6: Salvage and Accountability Building Subproject (06-D-141-09) Financial Data
(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	1,200,000	1,200,000	130,000	0	130,000	1,330,000
FY 2018	0	1,060,250	1,060,250	25,000	0	25,000	1,085,250
FY 2019	0	1,013,761	1,013,761	16,239	0	16,239	1,030,000
FY 2020	0	1,105,000	1,105,000	75,000	0	75,000	1,180,000
FY 2021	0	1,105,000	1,105,000	75,000	0	75,000	1,180,000
FY 2022	0	1,105,000	1,105,000	75,000	0	75,000	1,180,000
FY 2023	0	1,105,000	1,105,000	75,000	0	75,000	1,180,000

Table 3.7: Main Process Building Subproject (06-D-141-04) Financial Data
(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2016	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2017	1,880,000	2,138,723	4,018,723	319,500	0	319,500	4,338,223
FY 2018	1,926,000	2,511,973	4,437,973	390,000	0	390,000	4,827,973
FY 2019	1,855,809	2,867,630	4,723,439	159,347	0	159,347	4,882,786
FY 2020	1,838,000	2,613,143	4,451,143	280,643	0	280,643	4,731,786
FY 2021	1,838,000	2,613,143	4,451,143	280,643	0	280,643	4,731,786
FY 2022	1,838,000	2,613,143	4,451,143	280,643	0	280,643	4,731,786
FY 2023	1,838,000	2,603,343	4,441,343	280,643	0	280,643	4,721,986 [a]

2. Project Scope and Justification

Scope

The UPF Project is a design and construction project. The UPF Project consists of a series of industrial and nuclear buildings and supporting infrastructure. It is a major system acquisition that was selected in the Record of Decision for the Complex Transformation Supplemental Programmatic Environmental Impact Statement to ensure the long-term viability, safety, and security of the Enriched Uranium (EU) capability at the Y-12 National Security Complex. The UPF consists of 6 buildings, totaling 568,524 square feet. The UPF project focuses on modernizing uranium processing capabilities at Y-12 to reduce program and safety risk. The UPF project provides new buildings to replace the Building 9212 capabilities for Highly Enriched Uranium (HEU) casting, oxide production, recovery, decontamination, and assay. Coordination between Headquarters Acquisition and Project Management, the Uranium Program Manager, the NNSA Production Office (NPO), and the Y-12 Acquisition and Project Management Office (APMO) is essential as the uranium mission strategy and associated implementation plans define how the uranium capabilities are transitioned, relocated, sustained, and/or replaced.

The goals and objectives of the UPF Project are to support the following modernization strategy:

- Ensure the long-term capability and improve the reliability of EU operations;
- Replace deteriorating, end-of-life buildings with modern manufacturing buildings;
- Significantly improve the health and safety posture for workers and the public by replacing administrative controls with engineered controls to manage the risks related to worker safety, criticality safety, fire protection, and environmental compliance.

[a] Reflects a reduction in the MPB Construction cost as recovery of unearned fee to cover an increase in the MEB Subproject.

The UPF project consists of the following subprojects:

Site Readiness Subproject (06-D-141-01): The Site Readiness Subproject scope included Bear Creek Road relocation, including a bridge overpass of the haul road; installation of potable water lines paralleling the new road; electrical line demolition to make way for the road and clear the construction site; electrical line and communication cable installation; preparation of the West Borrow area to receive excess-soil and preparation and maintenance of a spoil area for wet soil; extension of an existing haul road for access to the construction site; and jack-and-bore installation of casings for future utilities. No change since the previous Request.

Site Infrastructure and Services (SIS) Subproject (06-D-141-05): The SIS Subproject scope included demolition of Building 9107 and its hillside, installation of haul road security features, completion of a sedimentation basin, a concrete batch plant, and completion of the Construction Support Building, which is 66,000 square feet. No change since the previous Request.

Substation Subproject (06-D-141-07): The Substation Subproject provided for the installation of the 161 kilovolt (kV) Main Electrical Substation for the UPF Project and capacity for most of the rest of the Y-12 plant. The Substation provides electrical power from the Tennessee Valley Authority (TVA) 161kV transmission system. The Substation Subproject includes all equipment, facilities, and structures needed for a fully operational substation. No change since the previous Request.

Mechanical Electrical Building (MEB) Subproject (06-D-141-06): The MEB Subproject constructed a 66,384 square feet facility and installed the utility equipment and support systems required by both the MPB and the SAB. The MEB is a stand-alone building housing mechanical, electrical, heating, ventilation, air conditioning, utility equipment, and support systems. The MEB is constructed to nonnuclear commercial industrial standards. This subproject includes a leased warehouse and fabrication facility; a cooling tower; and an onsite warehouse. Per the approved baseline change proposal, the MEB Subproject will be complete in August 2022.

Process Support Facilities (PSF) Subproject (06-D-141-08): The Process Support Facilities Subproject will construct a 23,914 square feet building and provide facilities for instrument air, demineralized water, waste management, and chemical and gas storage needed to support the MPB and SAB. No change since the previous Request.

Salvage and Accountability Building (SAB) Subproject (06-D-141-09): The SAB Subproject consists of two buildings totaling 160,113 square feet that will contain the following processes: waste preparation, decontamination, nondestructive analysis, the clean and contaminated shops, chemical recovery, calcination and leaching, electronics and calibration maintenance, filter room, and personnel-related rooms. The SAB will be constructed to standards commensurate with the radioactive hazard and security requirements for the materials and processes contained within. This subproject includes support buildings including a fire tank pump building as well as the Personnel Support Building which provides personnel access and monitoring station, truck bay, loading dock, and material access. Long lead equipment purchases associated with the SAB Subproject are allocated to the SAB TPC. No change since the previous Request.

> **Long Lead Procurements, CD-3B:** Included long lead gloveboxes, skids, and select long lead procurements for structural steel, rebar, embeds, and specialty items associated with SAB.

Main Process Building (MPB) Subproject (06-D-141-04): The MPB Subproject consists of a nuclear building totaling 252,113 square feet that will house the casting and oxide production capabilities. It also contains nondestructive analysis and waste preparations, furnaces and repacking, and spaces needed for process support such as the shift manager's office, restrooms, and other personnel-related rooms. The MPB will be constructed to nuclear standards commensurate with high-hazard materials and security for the processes to be carried out within. The MPB Subproject will include the construction of the Highly Enriched Uranium Materials Facility (HEUMF) connector, and the new Perimeter Intrusion Detection and Assessment System surrounding the UPF campus and support buildings. Design costs for the UPF project are included in the MPB Subproject baseline, as design costs are not tracked for each individual UPF subproject. No change since the previous Request.

> **Site Preparation and Long Lead Procurements, CD-3A:** Included excavation and fill for the MPB, SAB, and the MEB; installation of temporary facilities, power, storm water and sanitary sewers; and long lead procurements of tower cranes and rebar for the MEB slab.

Long Lead Procurements, CD-3B: Included long lead gloveboxes, skids, and select long lead procurements for structural steel, rebar, embeds, and specialty items associated with MPB.

Justification and Mission Need

The UPF Project is needed to ensure the long-term viability, safety, and security of the Enriched Uranium (EU) capability in the United States. The UPF Project will support the Nation's nuclear weapons stockpile, down blending of EU in support of nonproliferation, and provide uranium as feedstock for fuel for naval reactors. Currently, these capabilities reside in aged Manhattan Project-era facilities. There is substantial risk that the existing facilities will continue to deteriorate to the point of significant impact to Defense Programs, Defense Nuclear Nonproliferation, and Naval Reactors programs. The impacts could result in loss of the U.S. capability to maintain the nuclear weapons stockpile through life extension programs, shutdown of the U.S. Navy nuclear powered fleet due to lack of EU fuel feedstock materials, and impact to the Defense Nuclear Nonproliferation program's ability to reduce the enrichment level of foreign research reactors through supply of lower enrichment fuels manufactured at Y-12. The risk of inadvertent or accidental shutdown of the existing facilities is high and may occur prior to completion and startup of the UPF Project.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. Consistent with DOE O 413.3B, Earned Value (EV) information for all subprojects and the UPF design effort is reported in the Project Assessment and Reporting System (PARS). The Management and Operating (M&O) contractor received EV Management System certification approval from DOE in 2018. Funds appropriated under this data sheet may be used for the incremental funding and execution of the project on an annual basis. Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction.

The UPF project contingency was originally calculated using a detailed risk assessment in advance of CD-2/3. The contingency was updated at the completion of contract negotiations, and reflects additional contingency due to the favorable outcome of the negotiations (i.e., the contract value was lower than planned, resulting in additional contingency).

The UPF Mission Need Statement approved in December 2004, states that safe, efficient, and secure enriched uranium processing capabilities are needed within the Nuclear Weapons Complex to meet the mission of the DOE's NNSA. The UPF Project is needed to ensure the long-term viability, safety, and security of the EU capability in the United States. The UPF Mission Need was reexamined at each of the subsequent CD phases and remains valid.

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Table 4: Key Performance Parameters

Performance Measure	Threshold	Objective
UPF supports phasing out mission dependency on 9212	Threshold Performance Parameters are identified in the Classified Project Requirements Document	Objective Performance Parameters are identified in the Classified Project Requirements Document

3. Financial Schedule

UPF funding is appropriated at the Overall Project level (06-D-141) and is allocated to the subprojects in the tables below.

Table 5: Uranium Processing Facility Project (06-D-141) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	115,271	115,271	109,855
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886	301,886	198,448
FY 2015	270,929	269,823	220,761
FY 2016	298,000	297,978	309,154
FY 2017	179,884	179,748	326,205
FY 2018	9,562	10,954	115,718
Total Design	1,838,000	1,838,000	1,838,000
Construction			
FY 2012	0	0	0
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928
FY 2015	60,500	60,500	20,853
FY 2016	132,000[a]	132,000	32,270
FY 2017	395,116	395,116	89,918
FY 2018	653,438	653,438	298,467
FY 2019	701,980	701,853	568,246
FY 2020	740,000	739,973	826,841
FY 2021	718,500	718,500	890,993
FY 2022	546,500	546,500	906,297
FY 2023	219,000	219,000	373,469
FY 2024	72,589	72,743	173,943
FY 2025	0	0	70,870

[a] Allocation of funding and obligations reflects the final TPC of the Substation Subproject redeployed to cover a TPC increase in the MEB Subproject.

	Budget Authority (Appropriations)	Obligations	Costs
Total Construction	4,283,337	4,283,337	4,283,337
Total Estimated Costs (TEC)			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	115,271	115,271	109,855
FY 2012	160,194	160,109	170,700
FY 2013	312,783	312,740	197,631
FY 2014	301,886	301,886	224,376
FY 2015	331,429	330,323	241,614
FY 2016	430,000[a]	429,978	341,424
FY 2017	575,000	574,864	416,123
FY 2018	663,000	664,392	414,185
FY 2019	701,980	701,853	568,246
FY 2020	740,000	739,973	826,841
FY 2021	718,500	718,500	890,993
FY 2022	546,500	546,500	906,297
FY 2023	219,000	219,000	373,469
FY 2024	72,589	72,743	173,943
FY 2025	0	0	70,870
Total TEC	**6,121,337**	**6,121,337**	**6,121,337**
Other Project Costs (OPC)			
FY 2005	12,113	12,113	12,113
FY 2006	7,809	7,809	7,809
FY 2007	10,082	10,082	10,082
FY 2008	11,730	11,730	11,730
FY 2009	14,000	14,000	14,000
FY 2010	20,500	20,500	20,500
FY 2011	18,409[b]	18,409	18,409
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0

[a] Allocation of funding and obligations reflects the final TPC of the Substation Subproject redeployed to cover a TPC increase in the MEB Subproject.

[b] Updated to correctly represent the OPC funding allocated to the MPB subproject. This was an error in the prior year's CPDS and budget authority should have been aligned to the actual costs based on DCAA audit.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	1,020	1,020	0
FY 2020	5,000	5,000	1,083
FY 2021	31,500	31,500	2,631
FY 2022	53,500	53,500	63,361
FY 2023	143,000	143,000	115,380
FY 2024	50,000	50,000	101,565
FY 2025	0	0	0
Total OPC	**378,663**	**378,663**	**378,663**
Total Project Costs (TPC)			
FY 2005	12,113	12,113	12,113
FY 2006	12,809	12,809	7,809
FY 2007	15,082	15,082	10,759
FY 2008	50,313	50,313	45,680
FY 2009	104,622	104,622	93,184
FY 2010	114,500	114,500	101,459
FY 2011	133,680	133,680	128,264
FY 2012	160,194	160,109	170,700
FY 2013	312,783	312,740	197,631
FY 2014	301,886	301,886	224,376
FY 2015	331,429	330,323	241,614
FY 2016	430,000	429,978	341,424
FY 2017	575,000	574,864	416,123
FY 2018	663,000	664,392	414,185
FY 2019	703,000	702,873	568,246
FY 2020	745,000	744,973	827,924
FY 2021	750,000	750,000	893,624
FY 2022	600,000	600,000	969,658
FY 2023	362,000	362,000	488,849
FY 2024	122,589	122,743	275,508
FY 2025	0	0	70,870
Grand Total	**6,500,000**	**6,500,000**	**6,500,000**

Table 5.1: Site Readiness Subproject (06-D-141-01) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928
FY 2015	0	0	12,107
FY 2016	0	0	437
FY 2017	0	0	0
Total Construction	43,714	43,714	43,714
Total Estimated Costs (TEC)			
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928
FY 2015	0	0	12,107
FY 2016	0	0	437
FY 2017	0	0	0
Total TEC	**43,714**	**43,714**	**43,714**
Other Project Costs (OPC)			
FY 2017	0	0	0
Total OPC	0	0	0
Total Project Costs (TPC)			
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928
FY 2015	0	0	12,107
FY 2016	0	0	437
FY 2017	0	0	0
Grand Total	**43,714**	**43,714**	**43,714**

Table 5.2: Site Infrastructure and Services Subproject (06-D-141-05) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2015	60,500	[a]60,500	8,746
FY 2016	0	0	26,875
FY 2017	0	0	23,166
FY 2018	0	0	1,713
FY 2019	0	0	0
Total Construction	60,500	60,500	60,500
Total Estimated Costs (TEC)			
FY 2015	60,500	60,500	8,746
FY 2016	0	0	26,875
FY 2017	0	0	23,166
FY 2018	0	0	1,713
FY 2019	0	0	0
Total TEC	**60,500**	**60,500**	**60,500**
Other Project Costs (OPC)			
FY 2017	0	0	0
FY 2018	0	0	0
Total OPC	0	0	0
Total Project Costs (TPC)			
FY 2015	60,500	60,500	8,746
FY 2016	0	0	26,875
FY 2017	0	0	23,166
FY 2018	0	0	1,713
FY 2019	0	0	0
Grand Total	**60,500**	**60,500**	**60,500**

[a] Subproject received CD-4 approval in FY 2018 and completed under budget; baseline was $78,000,000, actual cost was $60,500,000.

Table 5.3: Substation Subproject (06-D-141-07) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2016	43,800[a]	43,800	0
FY 2017	0	0	11,064
FY 2018	0	0	26,101
FY 2019	0	0	6,635
FY 2020	0	0	0
Total Construction	43,800	43,800	43,800
Total Estimated Costs (TEC)			
FY 2016	43,800	43,800	0
FY 2017	0	0	11,064
FY 2018	0	0	26,101
FY 2019	0	0	6,635
FY 2020	0	0	0
Total TEC	**43,800**	**43,800**	**43,800**
Other Project Costs (OPC)			
FY 2016	0	0	0
FY 2017	0	0	0
Total OPC	0	0	0
Total Project Costs (TPC)			
FY 2016	43,800	43,800	0
FY 2017	0	0	11,064
FY 2018	0	0	26,101
FY 2019	0	0	6,635
FY 2020	0	0	0
Grand Total	**43,800**	**43,800**	**43,800**

[a] The approximately $16,200,000 of cost savings from the Substation Subproject has been redeployed to the MEB subproject to cover a TPC increase.

Table 5.4: Mechanical Electrical Building Subproject (06-D-141-06) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2016	16,200	16,200	0
FY 2017	55,000	55,000	1,425
FY 2018	160,000	160,000	35,061
FY 2019	67,980	67,980	61,043
FY 2020	0	0	107,361
FY 2021	0	0	68,093
FY 2022	9,800	9,800	35,997
Total Construction	308,980	308,980	308,980
Total Estimated Costs (TEC)			
FY 2016	16,200	16,200	0
FY 2017	55,000	55,000	1,425
FY 2018	160,000	160,000	35,061
FY 2019	67,980	67,980	61,043
FY 2020	0	0	107,361
FY 2021	0	0	68,093
FY 2022	9,800	9,800	35,997
Total TEC	308,980	308,980	308,980
Other Project Costs (OPC)			
FY 2019	1,020	1,020	0
FY 2020	0	0	28
FY 2021	0	0	880
FY 2022	0	0	112
Total OPC	1,020	1,020	1,020
Total Project Costs (TPC)			
FY 2016	16,200	16,200	0
FY 2017	55,000	55,000	1,425
FY 2018	160,000	160,000	35,061
FY 2019	69,000	69,000	61,043
FY 2020	0	0	107,389
FY 2021	0	0	68,973
FY 2022	9,800	9,800	36,109
Grand Total	**310,000**	**310,000**	**310,000**

Table 5.5: Process Support Facilities Subproject (06-D-141-08) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2018	15,000	15,000	2,139
FY 2019	30,000	30,000	6,853
FY 2021	19,000	19,000	36,535
FY 2022	0	0	49,465
FY 2023	0	0	4,469
Total Construction	118,000	118,000	118,000
Total Estimated Costs (TEC)			
FY 2018	15,000	15,000	2,139
FY 2019	30,000	30,000	6,853
FY 2020	54,000	54,000	18,539
FY 2021	19,000	19,000	36,535
FY 2022	0	0	49,465
FY 2023	0	0	4,469
Total TEC	**118,000**	**118,000**	**118,000**
Other Project Costs (OPC)			
FY 2020	1,000	1,000	0
FY 2021	21,000	21,000	0
FY 2022	0	0	12,000
FY 2023	0	0	10,000
Total OPC	22,000	22,000	22,000
Total Project Costs (TPC)			
FY 2018	15,000	15,000	2,139
FY 2019	30,000	30,000	6,853
FY 2020	55,000	55,000	18,539
FY 2021	40,000	40,000	36,535
FY 2022	0	0	61,465
FY 2023	0	0	14,469
Grand Total	**140,000**	**140,000**	**140,000**

Table 5.6: Salvage and Accountability Building Subproject (06-D-141-09) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2018	195,000	195,000	56,194
FY 2019	253,000	253,000	144,702
FY 2020	250,000	250,000	227,861
FY 2021	197,000	197,000	236,174
FY 2022	178,000	178,000	335,826
FY 2023	32,000	32,000	69,000
FY 2024	0	0	32,000
FY 2025	0	0	3,243
Total Construction	1,105,000	1,105,000	1,105,000
Total Estimated Costs (TEC)			
FY 2018	195,000	195,000	56,194
FY 2019	253,000	253,000	144,702
FY 2020	250,000	250,000	227,861
FY 2021	197,000	197,000	236,174
FY 2022	178,000	178,000	335,826
FY 2023	32,000	32,000	69,000
FY 2024	0	0	32,000
FY 2025	0	0	3,243
Total TEC	**1,105,000**	**1,105,000**	**1,105,000**
Other Project Costs (OPC)			
FY 2020	2,000	2,000	35
FY 2021	5,000	5,000	56
FY 2022	22,000	22,000	20,944
FY 2023	38,000	38,000	44,844
FY 2024	8,000	8,000	9,121
FY 2025	0	0	0
Total OPC	75,000	75,000	75,000
Total Project Costs (TPC)			
FY 2018	195,000	195,000	56,194
FY 2019	253,000	253,000	144,702
FY 2020	252,000	252,000	227,896
FY 2021	202,000	202,000	236,230

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	200,000	200,000	356,770
FY 2023	70,000	70,000	113,844
FY 2024	8,000	8,000	41,121
FY 2025	0	0	3,243
Grand Total	**1,180,000**	**1,180,000**	**1,180,000**

Table 5.7: Main Process Building Subproject (06-D-141-04) Financial Schedule
(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	115,271	115,271	109,855
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886[a]	301,886	198,448
FY 2015	270,929[b]	269,823	220,761
FY 2016	298,000	297,978	309,154
FY 2017	179,884	179,748	326,205
FY 2018	9,562	10,954	115,718
Total Design	1,838,000	1,838,000	1,838,000
Construction			
FY 2016	72,000	72,000	4,958
FY 2017	340,116	340,116	54,263
FY 2018	283,438	283,438	177,259
FY 2019	351,000	350,873	349,013
FY 2020	436,000	435,973	473,080
FY 2021	502,500	502,500	550,191
FY 2022	358,700	358,700	485,009

[a] In FY 2014, $5,000,000 in prior year funding was reprogrammed from 06-D-141, Uranium Processing Facility to Maintenance and Repair of Facilities at Y-12. Change from FY 2018 CPDS also reflects a rescission of $2,114,341.
[b] In FY 2016, $2,885,659 in prior year funding was reprogrammed from 06-D-141, Uranium Processing Facility to Uranium Sustainment: Storage under the Directed Stockpile Work program. Change from FY 2018 CPDS also reflects a rescission of $685,002.08.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2023	187,000	187,000	300,000
FY 2024	72,589	72,743	141,943
FY 2025	0	0	67,627
Total Construction	2,603,343	2,603,343	2,603,343
Total Estimated Costs (TEC)			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	115,271	115,271	109,855
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886	301,886	198,448
FY 2015	270,929	269,823	220,761
FY 2016	370,000	369,978	314,112
FY 2017	520,000	519,864	380,468
FY 2018	293,000	294,392	292,977
FY 2019	351,000	350,873	349,013
FY 2020	436,000	435,973	473,080
FY 2021	502,500	502,500	550,191
FY 2022	358,700	358,700	485,009
FY 2023	187,000	187,000	300,000
FY 2024	72,589	72,743	141,943
FY 2025	0	0	67,627
Total TEC	**4,441,343**	**4,441,343**	**4,441,343**
Other Project Costs (OPC)			
FY 2005	12,113	12,113	12,113
FY 2006	7,809	7,809	7,809
FY 2007	10,082	10,082	10,082
FY 2008	11,730	11,730	11,730
FY 2009	14,000	14,000	14,000
FY 2010	20,500	20,500	20,500
FY 2011	18,409	18,409	18,409
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	0	0

	Budget Authority (Appropriations)	Obligations	Costs
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	2,000	2,000	1,020
FY 2021	5,500	5,500	1,695
FY 2022	31,500	31,500	30,305
FY 2023	105,000	105,000	60,536
FY 2024	42,000	42,000	92,444
FY 2025	0	0	0
Total OPC	280,643	280,643	280,643
Total Project Costs (TPC)			
FY 2005	12,113	12,113	12,113
FY 2006	12,809	12,809	7,809
FY 2007	15,082	15,082	10,759
FY 2008	50,313	50,313	45,680
FY 2009	104,622	104,622	93,184
FY 2010	114,500	114,500	101,459
FY 2011	133,680	133,680	128,264
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886	301,886	198,448
FY 2015	270,929	269,823	220,761
FY 2016	370,000	369,978	314,112
FY 2017	520,000	519,864	380,468
FY 2018	293,000	294,392	292,977
FY 2019	351,000	350,873	349,013
FY 2020	438,000	437,973	474,100
FY 2021	508,000	508,000	551,886
FY 2022	390,200	390,200	515,314
FY 2023	292,000	292,000	360,536
FY 2024	114,589	114,743	234,387
FY 2025	0	0	67,627
Grand Total	**4,721,986**	**4,721,986**	**4,721,986**[a]

[a] Reflects a reduction in the MEB Construction cost as recovery of unearned fee to cover an increase in the MEB Subproject.

4. Details of Project Cost Estimate

Table 6: Details of UPF Project (06-D-141) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline[b]
Total Estimated Cost (TEC)			
Design			
Design	1,838,000	1,838,000	1,838,000
Contingency	0	0	0
Total Design	1,838,000	1,838,000	1,838,000
Construction			
Site Preparation	156,214	156,214	191,700
Equipment	1,081,640	1,158,950	1,370,180
Construction	2,457,703	2,340,893	2,420,463
Contingency	587,780	611,080	340,300
Total Construction	4,283,337	4,267,137	4,322,643
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	6,121,337	6,105,137	6,160,643
Contingency, TEC	587,780	611,080	340,300
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	30,000	30,000	30,000
Conceptual Design	64,643	64,643	64,643
Start-up	225,000	225,000	225,000
Contingency	59,020	59,020	59,000
Total, OPC	378,663	378,663	378,643
Contingency, OPC	59,020	59,020	59,000

[a] Previous Total Estimate reflects baseline values as of May 2020. The FY 2022 Project Data Sheet did not have the correct values for Current Total Estimate.
[b] The Original Validated Baseline reported in the FY 2022 Project Data Sheet did not reflect the CD-2 baseline approved and has been corrected.

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline[b]
Contingency from completed subprojects	0	16,200 [c]	0
Total Project Cost	**6,500,000**	**6,500,000**	**6,500,000** [d]
Total Contingency (TEC+OPC)	**646,800** [e]	**686,300**	**399,300**

Table 6.1: Details of Site Readiness Subproject (06-D-141-01) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	N/A
Contingency	0	0	N/A
Total Design	0	0	N/A
Construction			
Site Preparation	43,714	43,714	50,200
Equipment	0	0	0
Construction	0	0	0
Contingency	0	0	13,800
Total Construction	43,714	43,714	64,000
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	43,714	43,714	64,000
Contingency, TEC	0	0	13,800
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0

[a] Previous Total Estimate reflects baseline values as of May 2020. The FY 2022 Project Data Sheet did not have the correct values for Current Total Estimate.
[b] The Original Validated Baseline reported in the FY 2022 Project Data Sheet did not reflect the CD-2 baseline approved and has been corrected.
[c] Allocation of funding and obligations reflects the final TPC of the Substation Subproject. Per DOE O 413.3B, the $16.2 million of cost savings from the Substation Subproject has been returned to the Total Project contingency pool for other Subprojects within this CPDS, the funding for this contingency is from FY 2016.
[d] Excludes a $21,286,000 underrun from the Site Readiness CD-2/3 TPC and an $18,000,000 underrun from the Site Infrastructure and Services CD-2/3 TPC that had been realized prior to establishing the overall UPF CD-2 TPC baseline.
[e] Contingency will likely be required to address anticipated overruns of the Performance Measurement Baseline and Management Reserve due to contractor performance, as well as COVID impacts.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Start-up	0	0	1,000
Contingency	0	0	0
Total, OPC	0	0	1,000
Contingency, OPC	0	0	0
Total Project Cost	**43,714**	**43,714**	**65,000**
Total Contingency (TEC+OPC)	**0**	**0**	**13,800**

Table 6.2: Details of Site Infrastructure and Services Subproject (06-D-141-05) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	0	26,000
Equipment	0	0	0
Construction	60,500	60,500	30,000
Contingency	0	0	22,500
Total Construction	60,500	60,500	78,500
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	60,500	60,500	78,500
Contingency, TEC	0	0	22,500
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	0	0	0
Contingency	0	0	0
Total, OPC	0	0	0
Contingency, OPC	0	0	0
Total Project Cost	**60,500**	**60,500**	**78,500**
Total Contingency (TEC+OPC)	**0**	**0**	**22,500**

Table 6.3: Details of Substation Subproject (06-D-141-07) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline[a]
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	0	3,000
Equipment	0	0	49,700
Construction	43,800[b]	43,800	0
Contingency	0	0	7,300
Total Construction	43,800	43,800	60,000
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	43,800	43,800	60,000
Contingency, TEC	0	0	7,300
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	0	0	0
Contingency	0	0	0
Total, OPC	0	0	0
Contingency, OPC	0	0	0
Total Project Cost	**43,800**	**43,800**	**60,000**
Total Contingency (TEC+OPC)	**0**	**0**	**7,300**

[a] The Original Validated Baseline reported in the FY 2022 Project Data Sheet did not reflect the CD-2 baseline approved and has been corrected.

[b] Allocation of funding and obligations reflects the final TPC of the Substation Subproject. The approximately $16.2 million of cost savings from the Substation Subproject has been redeployed to MEB to cover a TPC increase.

Table 6.4: Details of Mechanical Electrical Building Subproject (06-D-141-06) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline[b]
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	0	0
Equipment	75,600	77,850	86,040
Construction	193,800	167,650	159,760
Contingency	39,580	37,480	38,200
Total Construction	308,980	282,980	284,000
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	308,980	282,980	284,000
Contingency, TEC	39,580	37,480	38,200
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	1,000	1,000	0
Contingency	20	20	0
Total, OPC	1,020	1,020	0
Contingency, OPC	20	20	0
Total Project Cost	**310,000**	**284,000**	**284,000**
Total Contingency (TEC+OPC)	**39,600**	**37,500**	**38,200**
BCP Approved in February 2022	**310,000**		

[a] Previous Total Estimate reflects baseline values as of May 2020. The FY 2022 Project Data Sheet did not have the correct values for Current Total Estimate.
[b] The Original Validated Baseline reported in the FY 2022 Project Data Sheet did not reflect the CD-2 baseline approved and has been corrected.

Table 6.5: Details of Process Support Facilities Subproject (06-D-141-08) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline[b]
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	0	0
Equipment	18,600	22,680	19,530
Construction	80,400	75,820	75,970
Contingency	19,000	19,500	22,500
Total Construction	118,000	118,000	118,000
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	118,000	118,000	118,000
Contingency, TEC	19,000	19,500	22,500
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	18,000	18,000	18,000
Contingency	4,000	4,000	4,000
Total, OPC	22,000	22,000	22,000
Contingency, OPC	4,000	4,000	4,000
Total Project Cost	**140,000**	**140,000**	**140,000**
Total Contingency (TEC+OPC)	**23,000**	**23,500**	**26,500**

[a] Previous Total Estimate reflects baseline values as of May 2020. The FY 2022 Project Data Sheet did not have the correct values for Current Total Estimate.

[b] The Original Validated Baseline reported in the FY 2022 Project Data Sheet did not reflect the CD-2 baseline approved and has been corrected.

Table 6.6: Details of Salvage and Accountability Building Subproject (06-D-141-09) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline[b]
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	0	0
Equipment	187,920	211,650	380,160
Construction	681,080	653,350	599,840
Contingency	236,000	240,000	125,000
Total Construction	1,105,000	1,105,000	1,105,000
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	1,105,000	1,105,000	1,105,000
Contingency, TEC	236,000	240,000	125,000
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	60,000	60,000	60,000
Contingency	15,000	15,000	15,000
Total, OPC	75,000	75,000	75,000
Contingency, OPC	15,000	15,000	15,000
Total Project Cost	**1,180,000**	**1,180,000**	**1,180,000**
Total Contingency (TEC+OPC)	**251,000**	**255,000**	**140,000**

[a] Previous Total Estimate reflects baseline values as of May 2020. The FY 2022 Project Data Sheet did not have the correct values for Current Total Estimate.

[b] The Original Validated Baseline reported in the FY 2022 Project Data Sheet did not reflect the CD-2 baseline approved and has been corrected.

Table 6.7: Details of Main Process Building Subproject (06-D-141-04) Cost Estimate
(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline[b]
Total Estimated Cost (TEC)			
Design			
Design	1,838,000	1,838,000	1,838,000
Contingency	0	0	0
Total Design	1,838,000	1,838,000	1,838,000
Construction			
Site Preparation	112,500	112,500	112,500
Equipment	799,520	846,770	834,750
Construction	1,398,123	1,339,773	1,554,893
Contingency	293,200	314,100	111,000
Total Construction	2,603,343	2,613,143	2,613,143
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	4,441,343	4,451,143	4,451,143
Contingency, TEC	293,200	314,100	111,000
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	30,000	30,000	30,000
Conceptual Design	64,643	64,643	64,643
Start-up	146,000	146,000	146,000
Contingency	40,000	40,000	40,000
Total, OPC	280,643	280,643	280,643
Contingency, OPC	40,000	40,000	40,000
Total Project Cost	**4,731,986**	**4,731,786**	**4,731,786**
Total Contingency (TEC+OPC)	**333,200**	**354,100**	**151,000**
Proposed TPC revision [c]	**4,721,986**		

[a] Previous Total Estimate reflects baseline values as of May 2020. The FY 2022 Project Data Sheet did not have the correct values for Current Total Estimate.

[b] The Original Validated Baseline reported in the FY 2022 Project Data Sheet did not reflect the CD-2 baseline approved and has been corrected.

[c] MPB TPC associated with recovery of unearned fee resulting in $9.8M of MPB TPC redeployed to cover MEB TPC increase and included in MEB construction in Table 6.4 above.

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Total
FY 2011	TEC	1,233,620	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	1,499,649	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2012	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2013	TEC	2,254,185	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	129,128	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	2,383,313	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2014	TEC	3,436,047	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	174,313	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	3,610,360	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2015	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	3,525,096	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2016	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	4,050,096	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2017	TEC	TBD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	TBD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	4,420,096	635,000	645,000	500,000	250,000	49,904	0	0	6,500,000
FY 2018	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	4,680,096	740,000	630,000	385,000	64,904	0	0	0	6,500,000
FY 2019	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	4,665,411	750,000	620,000	300,000	159,000	5,589	0	0	6,500,000
FY 2020	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	4,665,411	750,000	620,000	300,000	164,589	0	0	0	6,500,000
FY 2021	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	4,665,411	750,000	620,000	300,000	164,589	0	0	0	6,500,000
FY 2022	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	4,665,411	750,000	524,000[a]	TBD	TBD	0	0	0	6,500,000
FY 2023	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	4,665,411	750,000	600,000[a]	362,000	122,589	0	0	0	6,500,000

[a] Omnibus for FY2022 funded UPF at $600M.

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	12/31/2025
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset (fiscal quarter)	1Q FY 2076

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	$0.466	$0.466	$32.915	$32.915

7. D&D Information

The new area being constructed in this project is replacing existing facilities.

New Area being constructed at Y-12 National Security Complex	568,524 square feet
Area of D&D in this project at Y-12 National Security Complex	11,000 square feet[a]
Area at Y-12 National Security Complex to be transferred, sold, and/or D&D outside the project, including area previously "banked"	1,202,000 square feet
Area of D&D of this project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	0
Total Area Eliminated	N/A

8. Acquisition Approach

The NNSA Federal Project Director and the Integrated Project Team are responsible for the execution of the project. The Y-12 M&O contractor is the designated design authority. Designated officials within the Office of Defense Programs (NA-10) are responsible for defining program requirements and identifying project scope changes. The Office of Acquisition and Project Management (NA-APM) is responsible for providing support for alternative studies, and serves as the lead NNSA office for design and construction of the project.

The UPF Project construction scope is being performed under firm fixed price contracts or subcontracts along with cost-plus contracts as determined to be the best value for the government. The Department is administering Architect-Engineer and construction contracts utilizing the M&O contract and stand-alone contract vehicles. The United States Army Corps of Engineers (USACE) and Tennessee Valley Authority have had acquisition and project management responsibility for appropriate scopes of work as determined by the Department.

[a] Building 9107.

Chemistry and Metallurgy Research Replacement (CMRR) Project, 04-D-125
Los Alamos National Laboratory (LANL), Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary:
The Fiscal Year (FY) 2023 Request for the Chemistry and Metallurgy Research Replacement (CMRR) Project is $162,012,000, supporting subprojects for equipment installation into Plutonium Facility 4 (PF-4) and the Radiological Laboratory and Utility Office Building (RLUOB), and associated infrastructure for related operations in and around the two facilities.

The CMRR Project provides continuity in analytical chemistry (AC) and materials characterization (MC) capabilities through the relocation of programmatic operations from the existing Chemistry and Metallurgy Research (CMR) facility and provides infrastructure and support facilities for consolidated operations at the Technical Area -55 (TA-55) site.

Significant Changes:
The FY 2023 Construction Project Data Sheet (CPDS) is an update from FY 2022 and does not include a new start for the budget year. This data sheet updates the project to include, a) previously completed subprojects and b) continuation of the PF-4 Equipment Installation Phase 2 (PEI2) and RLUOB Hazard Category 3 (RC3) subprojects in design and execution planning.

Critical Decision (CD)-1 for all remaining subprojects was approved on August 21, 2014, with a combined CMRR top end of total project cost (TPC) range of $2,886,230,000. Portions of the CMRR Project scope have yet to be baselined and will be bounded to remain within the approved CMRR TPC range. Planning and design continue to mature to achieve CD-2/3 for the remaining scope and are forecasted to be complete by the third quarters of FY 2023 and 2024 for PEI2 and RC3 respectively. The final scope for each subproject will be established and agreed to at baselining, and outyear funding profiles may be adjusted to reflect those baselines. A phased execution strategy is being implemented for the remaining scopes of work to support the increased programmatic and construction needs of the site.

The current CMRR subprojects are listed below. Changes in subproject scope and phasing strategy may be identified as funding, design, and acquisition plans mature. Completed subprojects are described in Section 2 of this document.

RLUOB Subproject (04-D-125-01): *COMPLETE* - CD-4 approved on June 24, 2010.

RLUOB Equipment Installation (REI1) Subproject (04-D-125-02): *COMPLETE* - CD-4 approved on June 20, 2013.

Nuclear Facility (NF) Subproject (04-D-125-03): *CANCELLED* - This subproject was cancelled.

REI2 Subproject (04-D-125-04): *COMPLETE* – CD-4 approved on December 15, 2021, one month ahead of schedule. The approved project costs at CD-4 was $509,300,000, $124,000,000 below the TPC. The project is currently in final cost closeout and financial reconciliation. The tables below reflect the current cost to date of $516,850,000. Underruns for this subproject have been reallocated to the PEI2 and RC3 subprojects.

PEI1 Subproject (04-D-125-05): *COMPLETE* – CD-4 approved on January 8, 2021, more than one year ahead of schedule. The approved project cost at CD-4 was $284,000,000; $109,000,000 below the TPC. The project is currently in final cost closeout and financial reconciliation. The tables below reflect the current cost to date of $277,606,000. Underruns for this subproject have been reallocated to the PEI2 and RC3 subprojects.

PEI2 Subproject (04-D-125-06): Maximizes use of PF-4 by consolidating and relocating existing capabilities, replacing existing equipment, installing gloveboxes and equipment, demolition and disposal (D&D) of existing PF-4 laboratory space for AC/MC capabilities and development of infrastructure supporting AC/MC mission relocation to TA-55. PEI2 will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions. PEI2 also improves TA-55 and PF-4 personnel and vehicular ingress/egress, levels of worker preparation/staging and warehousing for relocated AC/MC operations and personnel. See Section 4 of this datasheet for additional detail on *Project Scope and Justification*.

Underruns from the PEI1 and REI2 will be utilized to develop performance baselines for all scope elements of the project. PEI2 will maintain the top end of the TPC cost range consistent with what was established at CD-1. The schedule range for completion is currently FY 2026 to FY 2029. In support of programmatic need dates, personnel and vehicular ingress/egress, levels of worker preparation/staging will need to achieve CD 2/3 sooner than PEI2 Equipment. An integrated master schedule will be developed for CD-2/3 approval which is forecasted for third quarter 2023.

RC3 Subproject (04-D-125-07): Maximizes use of RLUOB by reconfiguring existing laboratory space and equipping the remaining empty laboratories with AC and MC capabilities. Prior to the equipment installation, RC3 supports activities necessary to upgrade the RLUOB from a Radiological Facility to a Hazard Category 3 Nuclear Facility. The subsequent RC3 equipment installation will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions and provide for increased reliability of the pit production mission. RC3 also includes office and warehouse scope. Underruns from the PEI1 and REI2 will be utilized to develop performance baselines for all scope elements of the project. The project will maintain the top end of the range established at CD-1. The schedule range for completion is currently FY 2026 to FY 2028 An integrated master schedule will be developed for CD-2/3 which is forecasted for third quarter 2024.

A Level 4 Federal Project Director has been appointed to this project and has approved this data sheet.

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2004	07/16/2002	N/A	1QFY2004		N/A	2QFY2004	N/A	1QFY2011
FY 2005	07/16/2002	N/A	3QFY2004		N/A	3QFY2005	N/A	3QFY2012
FY 2006	07/16/2002	N/A	2QFY2005	4QFY2005	N/A	1QFY2006	N/A	4QFY2010
FY 2007	07/16/2002	N/A	09/30/2005	1QFY2006	N/A	1QFY2006	N/A	1QFY2013
FY 2008	07/16/2002	N/A	09/30/2005	10/21/2005	N/A	1QFY2006	N/A	1QFY2013
FY 2009	07/16/2002	N/A	09/30/2005	TBD	N/A	TBD	N/A	TBD
FY 2010	07/16/2002	N/A	09/30/2005	TBD	N/A	TBD	N/A	TBD
FY 2011	07/16/2002	N/A	05/18/2005	TBD	N/A	TBD	N/A	TBD
FY 2012	07/16/2002	N/A	05/18/2005	4QFY2012	N/A	4QFY2012	N/A	TBD
FY 2012 Rep	07/16/2002	N/A	05/18/2005	TBD	TBD	TBD	N/A	TBD
FY 2016	07/16/2002	N/A	4QFY2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	4QFY2024
FY 2017	07/16/2002	N/A	08/21/2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	4QFY2024
FY 2018	07/16/2002	N/A	08/21/2014	2QFY2022	3QFY2021	2QFY2022	4QFY2026	4QFY2026
FY 2019	07/16/2002	N/A	08/21/2014	4QFY2022	4QFY2022	4QFY2022	4QFY2026	4QFY2026
FY 2020	07/16/2002	N/A	08/21/2014	10/31/2016	12/1/2016	10/31/2016	N/A	3QFY2022
FY 2021	07/16/2002	N/A	08/21/2014	1QFY2023	2QFY2023	2QFY2023	4QFY2025	4QFY2029
FY 2022	07/16/2002	N/A	08/21/2014	4QFY2023	4QFY2023	4QFY2023	3QFY2028	4QFY2029[a]
FY 2023	07/16/2002	N/A	08/21/2014	3QFY2024	2QFY2024	3QFY2024	4QFY2029	4QFY2029a

[a] These dates reflect current planning estimates and will be revised when the remaining subprojects are baselined.

RLUOB Subproject (04-D-125-01)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	02/28/2010
FY 2012	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010
FY 2012 Rep	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010[a]

REI1 Subproject (04-D-125-02)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	04/30/2013
FY 2012	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	04/30/2013
FY 2012 Rep	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	06/30/2013[b]

Nuclear Facility (NF) Subproject (04-D-125-03)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	07/16/2002	N/A	05/18/2005	TBD	N/A	TBD	N/A	TBD
FY 2012	07/16/2002	N/A	05/18/2005	4QFY2012	N/A	4QFY2012	N/A	TBD
FY 2012 Rep	07/16/2002	N/A	05/18/2005	TBD	TBD	TBD	N/A	TBD
FY 2016	07/16/2002	N/A	05/18/2005	Cancelled	Cancelled	Cancelled	N/A	Cancelled[c]

REI2 Subproject (04-D-125-04)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	8/21/2014	8/21/2014	3QFY2016	2QFY2016	3QFY2016	N/A	1QFY2020
FY 2017	07/16/2002	8/21/2014	8/21/2014	3QFY2016	2QFY2016	3QFY2016	N/A	1QFY2020
FY 2018 PB	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	2QFY2022
FY 2019	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	2QFY2022
FY 2020	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	2QFY2022
FY 2021	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	2QFY2022
FY 2022	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	2QFY2022
FY 2023	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	12/20/2021

[a] This subproject is complete and the project history has not changed.

[b] This subproject is complete and the project history has not changed.

[c] This subproject was canceled and the project history has not changed.

Fiscal Quarter or Date

Fiscal Year	CD-3A	CD-3B
FY 2016	12/18/2014	2QFY2015
FY 2017	12/18/2014	12/22/2015
FY 2018	12/18/2014	12/22/2015
FY 2019	12/18/2014	12/22/2015
FY 2020	12/18/2014	12/22/2015
FY 2021	12/18/2014	12/22/2015
FY 2022	12/18/2014	12/22/2015
FY 2023	12/18/2014	12/22/2015

CD-3A – Approve Long-Lead Procurements
CD-3B – Approve Long-Lead Procurements

PEI1 Subproject (04-D-125-05)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	4QFY2015	4QFY2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	1QFY2024
FY 2017	07/16/2002	8/21/2014	08/21/2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	1QFY2020
FY 2018 PB	07/16/2002	8/21/2014	08/21/2014	10/31/2016	12/1/2016	10/31/2016	4QFY2019	3QFY2022
FY 2019	07/16/2002	8/21/2014	08/21/2014	10/31/2016	12/1/2016	10/31/2016	4QFY2019	3QFY2022
FY 2020	07/16/2002	8/21/2014	08/21/2014	10/31/2016	12/1/2016	10/31/2016	4QFY2019	3QFY2022
FY 2021	07/16/2002	8/21/2014	08/21/2014	10/31/2016	12/1/2016	10/31/2016	4QFY2019	3QFY2022
FY 2022	07/16/2002	8/21/2014	08/21/2014	10/31/2016	12/1/2016	10/31/2016	11/12/2019	1/08/2021[a]

Fiscal Quarter or Date

Fiscal Year	CD-3A	CD-3B
FY 2016	03/18/2015	12/22/2015
FY 2017	03/18/2015	12/22/2015
FY 2018	03/18/2015	12/22/2015
FY 2019	03/18/2015	12/22/2015
FY 2020	03/18/2015	12/22/2015
FY 2021	03/18/2015	12/22/2015
FY 2022	03/18/2015	12/22/2015

CD-3A – Approve Long-Lead Procurements
CD-3B – Approve Long-Lead Procurements

PEI2 Subproject (04-D-125-06)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	8/21/2014	4QFY2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	1QFY2024
FY 2021	07/16/2002	8/21/2014	8/21/2014	2QFY2023	2QFY2023	2QFY2023	4QFY2025	4QFY2028
FY 2022	07/16/2002	8/21/2014	8/21/2014	3QFY2023	3QFY2023	3QFY2023	3QFY2028	4QFY2029
FY 2023	07/16/2002	8/21/2014	8/21/2014	3QFY2023	2QFY2023	3QFY2023	4QFY2029	4QFY2029

[a] This subproject is complete and the project history has not changed.

Fiscal Quarter or Date

Fiscal Year	CD-3A	CD-3B
FY 2016	03/18/2015	
FY 2017	03/18/2015	
FY 2018	03/18/2015	
FY 2019	03/18/2015	
FY 2020	03/18/2015	
FY 2021	03/18/2015	2QFY2022
FY 2022	03/18/2015	02/03/2021
FY 2023	03/18/2015	02/09/2021

CD-3A – D&D of Room 209
CD-3B – Infrastructure scope/early site security/access

RC3 (04-D-125-07)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	08/21/2014	4QFY2014	3QFY2018	2QFY2017	4QFY2017	N/A	1QFY2024
FY 2021	07/16/2002	08/21/2014	4QFY2014	2QFY2023	2QFY2023	2QFY2023	N/A	4QFY2028
FY 2022	07/16/2002	08/21/2014	8/21/2014	4QFY2023	4QFY2023	1QFY2024	N/A	4QFY2028
FY 2023	07/16/2002	08/21/2014	8/21/2014	3QFY2024	2QFY2024	3QFY2024	N/A	4QFY2028

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2004	N/A	N/A	500,000	100,000	N/A	N/A	600,000
FY 2005	N/A	N/A	500,000	100,000	N/A	N/A	600,000
FY 2006	N/A	N/A	750,000	100,000	N/A	N/A	850,000
FY 2007	N/A	N/A	738,097	100,000	N/A	N/A	838,097
FY 2008	65,939	672,158	738,097	100,000	N/A	N/A	838,098
FY 2009	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2010	65,138	TBD	TBD	TBD	N/A	TBD	TBD
FY 2016	63,646	2,295,936	2,359,582	463,721	54,000	517,721	2,877,303
FY 2017	63,646	2,243,436	2,307,082	516,221	54,000	570,221	2,877,303
FY 2018	63,573	2,209,842	2,273,415	549,815	54,000	603,815	2,877,230
FY 2019	63,573	2,209,069	2,272,642	550,588	54,000	604,588	2,877,230
FY 2020	63,573	1,492,091	1,555,664	336,089	N/A	336,089	1,891,753[a]
FY 2021	63,573	2,209,069	2,272,642	550,588	54,000	604,588	2,877,230
FY 2022	63,573	2,241,987	2,305,560	526,670[b]	54,000	580,670	2,886,230
FY 2023	63,573	2,293,647	2,357,220	493,730	35,280	529,010	2,886,230[c]

RLUOB Subproject (04-D-125-01)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	N/A	159,130	159,130	4,870	N/A	4,870	164,000
FY 2012	N/A	159,130	159,130	4,870	N/A	4,870	164,000
FY 2012 Rep	N/A	159,130	159,130	4,870	N/A	4,870	164,000
FY 2016[d]	N/A	194,130	194,130	4,870	N/A	4,870	199,000

REI1 Subproject (04-D-125-02)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	N/A	152,900	152,900	46,500	N/A	46,500	199,400
FY 2012	N/A	152,900	152,900	46,500	N/A	46,500	199,400
FY 2012 Rep	N/A	152,900	152,900	46,500	N/A	46,500	199,400
FY 2016[e]	N/A	151,963	151,963	44,797	N/A	44,797	196,760

[a] In the FY 2020 CMRR Data Project Data Sheet the PEI2 and RC3 subprojects were removed from the CMRR project and funded under the Plutonium Pit Production Project in accordance with the Conference Report.

[b] The published FY 2022 CPDS OPC was incorrectly stated as $520,035,000. The rest of the FY 2022 numbers were correct. The FY 2022 number has been updated to correct this previous typographical error in the FY 2022 submittal.

[c] Until performance baselines are established for the remaining subprojects, the top of CD-1 range will be maintained.

[d] This subproject is complete and the project history has not changed.

[e] This subproject is complete and the project history has not changed.

NF Subproject (03-D-103 and 04-D-125-03)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	65,138	TBD	TBD	TBD	N/A	TBD	TBD
FY 2012	65,138	3,239,862 – 5,169,862	3,305,000 – 5,235,000	405,000 - 625,000	N/A	405,000- 625,000	3,710,000 - 5,860,000
FY 2012 Rep	65,138	TBD	TBD	4,870	N/A	TBD	TBD
FY 2016	63,646	391,324	454,970	40,274	N/A	40,274	495,244
FY 2017	63,646	391,324	454,970	40,274	N/A	40,274	495,244
FY 2018[a]	63,573	336,919	400,492	39,054	N/A	39,054	439,546

REI2 Subproject (04-D-125-04)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2016	0	540,000	540,000	135,000	N/A	135,000	675,000
FY 2017	0	540,000	540,000	135,000	N/A	135,000	675,000
FY 2018 PB	0	488,040	488,040	145,210	N/A	145,210	633,250
FY 2019	0	488,040	488,040	145,210	N/A	145,210	633,250
FY 2020	0	488,040	488,040	145,210	N/A	145,210	633,250
FY 2021	0	488,040	488,040	145,210	N/A	145,210	633,250
FY 2022	0	451,517	451,517	111,090	N/A	111,090	562,607
FY 2023	0	410,659	410,659	106,191	N/A	106,191	516,850[b]

PEI1 Subproject (04-D-125-05)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2016	0	1,071,000	1,071,000	240,000	54,000	294,000	1,365,000
FY 2017	0	257,595	257,595	57,405	N/A	57,405	315,000
FY 2018 PB	0	292,300	292,300	101,700	N/A	101,700	394,000
FY 2019	0	292,300	292,300	101,700	N/A	101,700	394,000
FY 2020	0	292,300	292,300	101,700	N/A	101,700	394,000
FY 2021	0	292,300	292,300	101,700	N/A	101,700	394,000
FY 2022	0	231,400	231,400	52,600	N/A	52,600	284,000
FY 2023	0	220,701	220,701	56,905	N/A	56,905	277,606[c]

[a] This subproject was canceled and the project history has not changed.

[b] REI2 achieved CD-4, with an approved TPC of $509,300,000. The subproject is currently in final costs closeout and this number will be updated to reflect the final TPC value after closeout is completed. The tables reflect the current cost to date of $516,850. Consistent with DOE O 413.3B, any TPC savings from CMRR subprojects are being used for execution of other CMRR subprojects as needed.

[c] PEI1 achieved CD-4 in January 2021 with an approved TPC of $284,000,000, the subproject is currently completing financial closeout and the actual will be updated to reflect the final costs in the next project data sheet. The tables reflect the current costs to date of $277,606,000.

PEI2 Subproject (04-D-125-06)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2016	0	471,500	471,500	159,500	54,000	213,500	685,000
FY 2020	0	28,739	28,739	296	N/A	296	29,035
FY 2021	0	475,242	475,242	146,098	54,000	200,098	675,340
FY 2022	0	538,662	538,662	156,533	54,000	210,533	749,195
FY 2023	0	590,413	590,413	118,356	35,280	153,636	744,049[a]

RC3 (04-D-125-07)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2016	0	289,405	289,405	75,595	N/A	75,595	365,000
FY 2020	0	0	0	162	N/A	162	162
FY 2021	0	270,475	270,475	68,859	N/A	68,859	339,334
FY 2022	0	337,396	337,396	117,726	N/A	117,726	455,122
FY 2023	0	388,862	388,862	123,557	N/A	123,557	512,419[b]

2. Project Scope and Justification

Scope

The CMRR Project, as originally proposed, relocated and consolidated mission critical AC, material MC, and actinide research and development (R&D) capabilities; and provided special nuclear material (SNM) storage and large vessel handling capabilities. The SNM storage and large vessel handling capabilities originally planned for CMRR-NF are not included in the current set of CMRR subprojects and have been addressed by programmatic operations. This data sheet provides information related to the two ongoing subprojects to transition AC and MC capabilities into RLUOB and PF-4, to ensure continuity in plutonium support capabilities and enable the cessation of program operations in CMR.

Changes in subproject and phasing strategy may be identified as design, funding, and acquisition plans mature. The list of CMRR line item subprojects since inception are:

- **RLUOB Subproject (04-D-125-01):** Construction of a 203,686 gross square foot (gsf) facility to house laboratory space capable of handling radiological quantities of SNM; a 22,071 gsf utility building sized to provide utility services (including chilled and hot water, potable hot/cold water, compressed air, and process gases) for all CMRR facility elements; office space for CMRR workers located outside of perimeter security protection systems; and space for centralized TA-55 training activities. The RLUOB became fully functional and operational after the completion of the equipment installation effort for this facility in the REI phase.

- **RLUOB Equipment Installation (REI) Subproject (04-D-125-02):** Equipment installation included gloveboxes, hoods, AC/MC instrumentation, security and communication hardware, and final facility tie-ins and operational

[a] The high end of the current cost range the subproject was increased to reflect the completion of PEI1 and REI2 subprojects and application of the underruns to the existing scope. The underruns are being used/made available to address existing scope as performance baselines are established. Until a performance baseline for all scope elements of the project is achieved, the project will maintain the top end of the range established at CD-1.

[b] The high end of the current cost range the subproject was increased to reflect the completion of PEI1 and REI2 subprojects and application of the underruns to the existing scope. The underruns are being used/made available to address existing scope as performance baselines are established. Until a performance baseline for all scope elements of the project is achieved, the project will maintain the top end of the range established at CD-1.

readiness/turnover activities. RLUOB equipment fabrication, installation, testing, and acceptance physically completed in FY 2012. Staff occupation of the office spaces in FY 2012 occurred and CD-4 was approved. The facility exceeded its sustainability goal of LEED Silver by achieving LEED Gold in June 2012.

- **Nuclear Facility (NF) Subproject (04-D-125-03):** This subproject is cancelled with the remaining mission need (excluding SNM storage and large vessel handling) for CMRR to be met by REI2, PEI1, PEI2 and RC3.

- **REI Phase 2 (REI2) Subproject (04-D-125-04):** Maximizes the use of RLUOB laboratories by both reconfiguring some existing laboratory space and equipping empty laboratories with AC and MC capabilities. Until the RC3 subproject is complete, the RLUOB will operate at the increased radiological limit, 38.6 g of Pu-239 equivalent, consistent with the new limit established by NNSA Supplemental Guidance NA-1 SD G 1027, which enables additional AC and MC operations to move in. New gloveboxes/hoods and equipment will be installed in RLUOB through this subproject. This project makes progress toward ceasing program operations in CMR. Specific capabilities in REI2 scope include the following:

  - Trace Elements Sample Preparation
  - Mass Spectrometry Sample Preparation
  - X-Ray Fluorescence Sample Preparation and Instruments
  - Radiochemistry Counting Laboratory and Sample Preparation
  - Oxide and Metal Sample Distribution
  - Coulometry
  - AC and MC Capabilities for R&D and Troubleshooting

- **PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05):** The PEI1 subproject involved the following: relocation of existing PF-4 processes within PF-4 to create open consolidated space, reusing existing gloveboxes for new processes, decontamination and decommissioning (D&D) of old gloveboxes/equipment in PF-4 to create open laboratory space; and installation of new gloveboxes/equipment in the created open space. PEI1 supports the AC and MC capabilities that require the processing of larger amounts of nuclear material. This project made progress toward ceasing program operations in CMR. These capabilities support pit production, pit surveillance, plutonium science and other national security programs. The removal work was executed as site-prep work within this subproject. Specific capabilities in PEI1 scope included:

  - Sample Preparation Surface Science
  - Mechanical Testing
  - Physical Properties
  - Small Sample Fabrication and Preparation

- **PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06):** This scope will maximize use of PF-4 by consolidating and relocating existing capabilities within PF-4, replacing existing equipment, installing gloveboxes and equipment and decontamination and demolition of existing laboratory equipment to create space for relocated AC/MC equipment. PEI2 will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions, including pit production. PEI2 if needed will accomplish infrastructure scope necessary to support the CMRR project, and to accommodate the relocation of personnel and supporting facilities to TA-55. Included are facilities upgrades and new construction of:
  - Increased capacity for change rooms leading into PF-4.
  - Upgrade in capacity for vehicular entrance/exit to and from TA-55.
  - Upgrades to existing PF-4 ingress/egress security posts for essential capacity increases related to CMRR missions.

  The preliminary cost range for the work in this subproject is $675,340,000 - $744,049,000 and schedule range 2026 to 2029. The cost estimate will be updated prior to CD-2/3 approval for this subproject. An integrated master schedule will be developed for CD-2/3. The CD-3B approved in February 9, 2021 included increasing change rooms capacity and upgrade to one of the existing PF-4 ingress/egress security posts identified above.

- **RLUOB Hazard Category 3 (RC3) (04-D-125-07):** This scope will maximize use of RLUOB by reconfiguring existing laboratory space and equipping the remaining empty laboratories with AC and MC capabilities and supports the conversion of the Radiological Laboratory to a Hazard Category 3 Nuclear Facility. RC3 equipment installation will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions. RC3 also includes new construction of:

- Office building in the vicinity of TA-55
- Warehousing for handling of equipment procurement/inspection/preparation/installation.

The preliminary cost range for the work in this subproject is $339,334,000 - $512,419,000 and schedule range of 2026 to 2028; the cost estimate will be updated prior to CD-2/3 approval for this subproject. An integrated master schedule will be developed for CD-2/3.

Justification

As defined in the most recent revision of the Mission Need Statement (MNS), the mission of the CMRR Project is to ensure continuity in AC and MC capabilities for NNSA actinide-based missions in support of stockpile stewardship. The AC and MC capabilities provided by this project support pit production, pit surveillance, plutonium science and other national security programs. During development of the plutonium strategy, the joint Department of Defense-Cost Analysis and Program Evaluation business case analysis indicated that optimizing RLUOB and repurposing space in PF-4 should be started as soon as possible to maintain continuity in AC and MC capabilities.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director to conduct independent assessments of the planning and execution of this project required by DOE O 413.3B and to conduct technical reviews of design and construction documents.

Key Performance Parameters (KPPs)

REI2 Subproject (04-D-125-04): Transfer AC/MC capabilities from CMR to the RLUOB and complete transition to operations (i.e., preparation of operational startup, management self-assessments and hot testing) of AC/MC capabilities in eight RLUOB laboratory rooms as referenced in the CMRR REI2 and PEI1 Transition to Operations (TTO) Plan (CMRR-PLAN-00004) and PEP section 5.19 Transition to Operations.

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06) This scope will maximize use of PF-4 by consolidating and relocating existing capabilities into Room 209, replacing existing equipment, installing gloveboxes and equipment and D&D of existing laboratory space for AC/MC capabilities and will be referenced in the PEI2 Transition to Operations (TTO) Plan and PEP section for Transition to Operations once developed in preparation for CD-2.

RLUOB Hazard Category 3 (RC3) (04-D-125-07): This scope will maximize use of RLUOB by reconfiguring existing laboratory space and equipping the remaining empty laboratories with AC and MC systems. Capabilities will be referenced in the REI3 Transition to Operations (TTO) Plan and PEP section for Transition to Operations once developed in preparation for CD-2.

3. Financial Schedule

Prior Subprojects (RLUOB/REI/Nuclear Facility) 03-D-103-010[a] & 04-D-125-01, -02, -03)

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Total Estimated Costs (TEC)			
Design (03-D-103-010)			
Prior Years - FY 2018	63,573	63,573	63,573
Total Design (03-D-103-010)	**63,573**	**63,573**	**63,573**
Design (04-D-125)			
Prior Years - FY 2018	386,929	386,929	386,929
Total Design (04-D-125)	**386,929**	**386,929**	**386,929**
Total Design			
Prior Years - FY 2018	450,502	450,502	450,502
Total Design (04-D-125)	**450,502**	**450,502**	**450,502**
Construction (04-D-125)			
Prior Years - FY 2018	296,083	296,083	296,083
Total Construction (04-D-125)	**296,083**	**296,083**	**296,083**
TEC (04-D-125)			
Prior Years - FY 2018	746,585	746,585	746,585
Total TEC (04-D-125)	**746,585**	**746,585**	**746,585**
Other Project Cost (OPC)			
(OPC except D&D)			
Prior Years - FY 2018	88,721	88,721	88,721
Total OPC except D&D (04-D-125)	**88,721**	**88,721**	**88,721**
Total Project Cost (TPC)			
Prior Years - FY 2018	835,306	835,306	835,306
Total TPC (03-D-103-010 & 04-D-125-01, -02, -03)	**835,306**	**835,306**	**835,306**

[a] 03-D-103-010 CPDS funded design efforts on multiple line item projects starting in 2003. Subsequently the funding of design and construction was shifted to 04-D-125.

REI Phase 2 (REI2) Subproject (04-D-125-04)

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-04)			
Prior Years - FY 2018	42,179	42,179	42,179
FY 2019	333	333	333
FY 2020	0	0	0
FY 2021	0	0	0
Total Design (04-D-125-04)	**42,512**	**42,512**	**42,512**
Construction (04-D-125-04)			
Prior Years - FY 2018	282,289	241,682	228,937
FY 2019	98,929	78,579	76,195
FY 2020	23,747	84,688	48,846
FY 2021	4,040	4,056	12,169
FY 2022[a]	-40,858	-40,858	2,000
FY 2023	0	0	0
FY 2024	0	0	0
Total Construction (04-D-125-04)	**368,147**	**368,147**	**368,147**
TEC (04-D-125-04)			
Prior Years - FY 2018	324,468	283,861	271,116
FY 2019	99,262	78,912	76,528
FY 2020	23,747	84,688	48,846
FY 2021	4,040	4,056	12,169
FY 2022	-40,858	-40,858	2,000
FY 2023	0	0	0
FY 2024	0	0	0
Total TEC (04-D-125-04)	**410,659**	**410,659**	**410,659**

[a] $40,858 was reallocated from REI2 TEC Construction to remaining subprojects.

	Budget Authority (Appropriations)	Obligations	Cost
Other Project Cost (OPC) **(OPC except D&D)**			
Prior Years - FY 2018	49,462	45,663	23,417
FY 2019	46,652	40,000	13,067
FY 2020	11,628	22,079	29,951
FY 2021	0	0	34,756
FY 2022	-1,551	-1,551	5,000
FY 2023	0	0	0
FY 2024	0	0	0
Total OPC except D&D (04-D-125-04)	**106,191**	**106,191**	**106,191**
Total Project Cost (TPC)			
Prior Years - FY 2018	373,930	329,524	294,533
FY 2019	145,914	118,912	89,595
FY 2020	35,375	106,767	78,797
FY 2021	4,040	4,056	46,925
FY 2022	-42,409	-42,409	7,000
FY 2023	0	0	0
FY 2024	0	0	0
Total TPC (04-D-125-04)	**516,850**[a]	**516,850**	**516,850**

[a] The sub-project costs have been evaluated in the final project year and consistent with DOE O 413.3B, any TPC savings from CMRR subprojects are being used for execution of other CMRR subprojects as needed

PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05)
(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-05)			
Prior Years - FY 2018	31,611	31,611	31,611
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
Total Design (04-D-125-05)	**31,611**	**31,611**	**31,611**
Construction (04-D-125-05)			
Prior Years - FY 2018	157,704	156,435	110,245
FY 2019	42,085	43,354	53,745
FY 2020	0	0	21,395
FY 2021	0	0	3,205
FY 2022	-10,699	-10,699	500
FY 2023	0	0	0
FY 2024	0	0	0
Total Construction (04-D-125-05)	**189,090**[a]	**189,090**	**189,090**
Prior Years - FY 2018	189,315	188,046	141,856
FY 2019	42,085	43,354	53,745
FY 2020	0	0	21,395
FY 2021	0	0	3,205
FY 2022	-10,699	-10,699	500
FY 2023	0	0	0
FY 2024	0	0	0
Total TEC (04-D-125-05)	**220,701**	**220,701**	**220,701**
Other Project Cost (OPC)			
(OPC except D&D)			
Prior Years - FY 2018	37,292	35,505	24,678
FY 2019	18,656	12,961	15,830
FY 2020	0	7,482	15,440
FY 2021	457	457	457
FY 2022	500	500	500
FY 2023	0	0	0
FY 2024	0	0	0
Total OPC except D&D (04-D-125-05)	**56,905**	**56,905**	**56,905**
Total Project Cost (TPC)			
Prior Years - FY 2018	226,607	223,551	166,534
FY 2019	60,741	56,315	69,575
FY 2020	0	7,482	36,835
FY 2021	457	457	3,662
FY 2022	-10,199	-10,199	1,000

[a] The sub-project was completed in FY 2021. Consistent with DOE O 413.3B, TPC savings from CMRR subprojects are being used for execution of other CMRR subprojects.

	Budget Authority (Appropriations)	Obligations	Cost
FY 2023	0	0	0
FY 2024	0	0	0
Total TPC (04-D-125-05)	**277,606**	**277,606**	**277,606**[a]

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-06)			
Prior Years - FY 2018	16,915	16,915	14,991
FY 2019	13,187	13,187	1,595
FY 2020	84,788	84,788	825
FY 2021	9,921	9,921	19,132
FY 2022	0	0	38,146
FY 2023	4,329	4,329	54,451
FY 2024	0	0	0
Total Design (04-D-125-06)	**129,140**	**129,140**	**129,140**
Construction (04-D-125-06)			
Prior Years - FY 2018	21,748	21,748	21,241
FY 2019	0	0	-1,611
FY 2020	43,508	43,508	0
FY 2021	85,384	85,384	3,875
FY 2022	110,799	110,799	46,652
FY 2023	95,671	95,671	58,687
FY 2024	80,163	80,163	114,680
FY 2025	0	0	108,067
FY 2026	0	0	73,718
FY 2027	0	0	11,964
FY 2028	0	0	0
FY 2029	0	0	0
Total Construction (04-D-125-06)	**437,273**	**437,273**	**437,273**
TEC (04-D-125-06)			
Prior Years - FY 2018	38,663	38,663	36,232
FY 2019	13,187	13,187	-16
FY 2020	128,296	128,296	825
FY 2021	95,305	95,305	23,007
FY 2022	110,799	110,799	84,798
FY 2023	100,000	100,000	113,138
FY 2024	80,163	80,163	114,680
FY 2025	0	0	108,067

[a] The CD-4 approved TPC value is $284,000,000. The project is currently in financial closeout and the final value will be updated once this is completed. The current costs to date are $277,606,000.

	Budget Authority (Appropriations)	Obligations	Cost
FY 2026	0	0	73,718
FY 2027	0	0	11,964
FY 2028	0	0	0
FY 2029	0	0	0
Total TEC (04-D-125-06)	**566,413**	**566,413**	**566,413**
Other Project Cost (OPC)			
(OPC non capital)			
Prior Years - FY 2018	296	296	296
FY 2019	6,142	6,142	1,480
FY 2020	0	0	503
FY 2021	0	0	650
FY 2022	0	0	3,509
FY 2023	0	0	0
Total OPC non capital (04-D-125-06)	**6,438**	**6,438**	**6,438**
Other Project Cost (OPC)			
(OPC except D&D)			
Prior Years - FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	14,793	14,793	32
FY 2022	15,650	15,650	0
FY 2023	0		0
FY 2024	0	0	1,680
FY 2025	58,020	58,020	420
FY 2026	0	0	3,045
FY 2027	0	0	42,618
FY 2028	0	0	25,000
FY 2029	0	0	15,668
Total OPC except D&D (04-D-125-06)	**88,463**	**88,463**	**88,463**
Other Project Cost (OPC) D&D			
Prior Years - FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	24,000	24,000	0
FY 2025	0	0	0
FY 2026	0	0	0
FY 2027	0	0	0
FY 2028	0	0	20,000
FY 2029	0	0	4,000
Total OPC D&D (04-D-125-06)	**24,000**	**24,000**	**24,000**

	Budget Authority (Appropriations)	Obligations	Cost
Total Other Project Cost (OPC)			
Prior Years - FY 2018	296	296	296
FY 2019	6,142	6,142	1,480
FY 2020	0	0	503
FY 2021	14,793	14,793	682
FY 2022	15,650	15,650	3,509
FY 2023	0	0	0
FY 2024	24,000	24,000	1,680
FY 2025	58,020	58,020	420
FY 2026	0	0	3,045
FY 2027	0	0	42,618
FY 2028	0	0	45,000
FY 2029	0	0	19,668
Total OPC (04-D-125-06)	**118,901**	**118,901**	**118,901**
Total Project Cost (TPC)			
Prior Years - FY 2018	38,959	38,959	36,528
FY 2019	19,329	19,329	1,464
FY 2020	128,296	128,296	1,328
FY 2021	110,098	110,098	23,689
FY 2022	126,449	126,449	88,307
FY 2023	100,000	100,000	113,138
FY 2024	104,163	104,163	116,360
FY 2025	58,020	58,020	108,487
FY 2026	0	0	76,763
FY 2027	0	0	54,582
FY 2028	0	0	45,000
FY 2029	0	0	19,668
Total TPC (04-D-125-06)	**685,314**	**685,314**	**685,314**

RLUOB Hazard Category 3 (RC3) (04-D-125-07)

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-07)			
Prior Years - FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	4,773	4,773	0
FY 2021	15,748	15,748	5,285
FY 2022	26,636	26,636	16,902
FY 2023	30,430	30,430	55,400
FY 2024	37,061	37,061	37,061
FY 2025	0	0	
Total Design (04-D-125-07)	**114,648**	**114,648**	**114,648**
Construction (04-D-125-07)			
Prior Years - FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	25,092	25,092	0
FY 2023	31,582	31,582	18,546
FY 2024	107,693	107,693	73,701
FY 2025	89,847	89,847	96,547
FY 2026	0	0	49,331
FY 2027	0	0	16,089
Total Construction (04-D-125-07)	**254,214**	**254,214**	**254,214**
TEC (04-D-125-07)			
Prior Years - FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	4,773	4,773	0
FY 2021	15,748	15,748	5,285
FY 2022	51,728	51,728	16,902
FY 2023	62,012	62,012	73,946
FY 2024	144,754	144,754	110,762
FY 2025	89,847	89,847	96,547
FY 2026	0	0	49,331
FY 2027	0	0	16,089
Total TEC (04-D-125-07)	**368,862**	**368,862**	**368,862**

	Budget Authority (Appropriations)	Obligations	Cost
Other Project Cost (OPC)			
(OPC non capital)			
Prior Years - FY 2018	162	162	162
FY 2019	6,035	6,035	838
FY 2020	4,787	2,510	4,126
FY 2021	0	2,277	5,858
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
Total OPC non capital (04-D-125-07)	**10,984**	**10,984**	**10,984**
(OPC except D&D)			
Prior Years - FY 2018	1,000	1,000	324
FY 2019	11,000	11,000	542
FY 2020	0	0	415
FY 2021	39,084	39,084	12,301
FY 2022	12,554	12,554	0
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	20,000	20,000	0
FY 2026	0	0	29,328
FY 2027	0	0	20,728
FY 2028	0	0	20,000
Total OPC except D&D (04-D-125-07)	**83,638**	**83,638**	**83,638**
Total Other Project Cost (OPC)			
Prior Years - FY 2018	1,162	1,162	486
FY 2019	17,035	17,035	1,380
FY 2020	4,787	2,510	4,541
FY 2021	39,084	41,361	18,159
FY 2022	12,554	12,554	0
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	20,000	20,000	0
FY 2026	0	0	29,328
FY 2027	0	0	20,728
FY 2028	0	0	20,000
Total OPC (04-D-125-07)	**94,622**	**94,622**	**94,622**

	Budget Authority (Appropriations)	Obligations	Cost
Total Project Cost (TPC)			
Prior Years - FY 2018	1,162	1,162	486
FY 2019	17,035	17,035	1,380
FY 2020	9,560	7,283	4,541
FY 2021	54,832	57,109	23,444
FY 2022	64,282	64,282	16,902
FY 2023	62,012	62,012	73,946
FY 2024	144,754	144,754	110,762
FY 2025	109,847	109,847	96,547
FY 2026	0	0	78,659
FY 2027	0	0	36,817
FY 2028	0	0	20,000
Total TPC (04-D-125-07)	**463,484**	**463,484**	**463,484**

Total Project

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (03-D-103-010)			
Prior Years - FY 2018	63,573	63,573	63,573
Total Design (03-D-103-010)	**63,573**	**63,573**	**63,573**
Design (04-D-125)			
Prior Years - FY 2018	477,634	477,634	475,710
FY 2019	13,520	13,520	1,928
FY 2020	89,561	89,561	825
FY 2021	25,669	25,669	24,417
FY 2022	26,636	26,636	55,048
FY 2023	34,759	34,759	109,851
FY 2024	37,061	37,061	37,061
FY 2025	0	0	0
Total Design (04-D-125)	**704,840**	**704,840**	**704,840**

	Budget Authority (Appropriations)	Obligations	Cost
Construction			
Prior Years - FY 2018	757,824	715,948	656,506
FY 2019	141,014	121,933	128,329
FY 2020	67,255	128,196	70,241
FY 2021	89,424	89,440	19,249
FY 2022	84,334	84,334	49,152
FY 2023	127,253	127,253	77,233
FY 2024	187,856	187,856	188,381
FY 2025	89,847	89,847	204,614
FY 2026	0	0	123,049
FY 2027	0	0	28,053
FY 2028	0	0	0
FY 2029	0	0	0
Total Construction (04-D-125)	**1,544,807**	**1,544,807**	**1,544,807**
TEC			
Prior Years - FY 2018	1,299,031	1,257,155	1,195,789
FY 2019	154,534	135,453	130,257
FY 2020	156,816	217,757	71,066
FY 2021	115,093	115,109	43,666
FY 2022	110,970	110,970	104,200
FY 2023	162,012	162,012	187,084
FY 2024	224,917	224,917	225,442
FY 2025	89,847	89,847	204,614
FY 2026	0	0	123,049
FY 2027	0	0	28,053
FY 2028	0	0	0
FY 2029	0	0	0
Total TEC (04-D-125)	**2,313,220**	**2,313,220**	**2,313,220**
Other Project Cost (OPC)			
(OPC non capital)			
Prior Years - FY 2018	89,179	89,179	89,179
FY 2019	12,177	12,177	2,318
FY 2020	4,787	2,510	4,629
FY 2021	0	2,277	6,508
FY 2022	0	0	3,509
FY 2023	0	0	0
FY 2024	0	0	0
Total OPC non capital	**106,143**	**106,143**	**106,143**

	Budget Authority (Appropriations)	Obligations	Cost
Other Project Cost (OPC)			
(OPC except D&D)			
Prior Years - FY 2018	87,754	82,168	48,419
FY 2019	76,308	63,961	29,439
FY 2020	11,628	29,561	45,806
FY 2021	54,334	54,334	47,546
FY 2022	27,153	27,153	5,500
FY 2023	0	0	0
FY 2024	0	0	1,680
FY 2025	78,020	78,020	420
FY 2026	0	0	32,373
FY 2027	0	0	63,346
FY 2028	0	0	45,000
FY 2029	0	0	15,668
Total OPC except D&D (04-D-125)	**335,197**	**335,197**	**335,197**
Other Project Cost (OPC) D&D			
OPC D&D			
Prior Years - FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	24,000	24,000	0
FY 2025	0	0	0
FY 2026	0	0	0
FY 2027	0	0	0
FY 2028	0	0	20,000
FY 2029	0	0	4,000
Total OPC D&D (04-D-125)	**24,000**	**24,000**	**24,000**

	Budget Authority (Appropriations)	Obligations	Cost
OPC Total			
Prior Years - FY 2018	176,933	171,347	137,598
FY 2019	88,485	76,138	31,757
FY 2020	16,415	32,071	50,435
FY 2021	54,334	56,611	54,054
FY 2022	27,153	27,153	9,009
FY 2023	0	0	0
FY 2024	24,000	24,000	1,680
FY 2025	78,020	78,020	420
FY 2026	0	0	32,373
FY 2027	0	0	63,346
FY 2028	0	0	65,000
FY 2029	0	0	19,668
Total OPC (04-D-125)	**465,340**	**465,340**	**465,340**
Total Project Costs (TPC)			
Prior Years - FY 2018	1,475,964	1,428,502	1,333,387
FY 2019	243,019	211,591	162,014
FY 2020	173,231	249,828	121,501
FY 2021	169,427	171,720	97,720
FY 2022	138,123	138,123	113,209
FY 2023	162,012	162,012	187,084
FY 2024	248,917	248,917	227,122
FY 2025	167,867	167,867	205,034
FY 2026	0	0	155,422
FY 2027	0	0	91,399
FY 2028	0	0	65,000
FY 2029	0	0	19,668
Total TPC	**2,778,560**	**2,778,560**	**2,778,560**

4. Details of Project Cost Estimate

Prior Subprojects (RLUOB/REI/Nuclear Facility) 03-D-103-010 & 04-D-125-01, -02, -03)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			N/A
Design			N/A
Contingency			N/A
Total, Design	450,502	450,502	N/A
Construction			N/A
Site Work			N/A
Equipment			N/A
Construction			N/A
Contingency			N/A
Total, Construction	296,083	296,083	N/A
Total Estimated Cost	**746,585**	**746,585**	**N/A**
Contingency, TEC			
Other Project Cost (OPC)			
OPC except D&D			
R&D			N/A
Conceptual Planning			N/A
Conceptual Design			N/A
Other OPC Costs			N/A
Contingency			N/A
Total, OPC	88,721	88,721	N/A
Contingency, OPC			
Total Project Cost	835,306	835,306	N/A
Total Contingency (TEC+OPC)			N/A

REI Phase 2 (REI2) Subproject (04-D-125-04)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design			N/A
Contingency			N/A
Total, Design	42,512	42,179	44,816
Construction			
Site Work	4,463	5,461	5,461
Equipment	42,750	52,089	52,089
Construction	320,934	271,128	305,023
Contingency	0	80,651	80,651
Total, Construction	368,147	409,329	443,224
Total Estimated Cost	**410,659**	**451,517**	**488,040**
Contingency, TEC	0	80,651	80,651
Other Project Cost (OPC)			
OPC except D&D			
R&D			
Conceptual Planning	2,595	1,883	1,883
Conceptual Design	3,670	2,663	2,663
Other OPC Costs	99,926	81,070	81,070
Contingency	0	25,474	59,594
Total, OPC	106,191	111,090	145,210
Contingency, OPC	0	25,474	59,594
Total Project Cost	**516,850**[a]	**562,607**	**633,250**
Total Contingency (TEC+OPC)	**0**	**106,125**	**140,245**

[a] REI2 achieved CD-4, with an approved TPC of $509,300,000. The subproject is currently in final costs closeout and this number will be updated to reflect the final TPC value after closeout is completed. The tables reflect the current cost to date of $516,850.

PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design			N/A
Contingency			N/A
Total, Design	31,611	31,611	34,308
Construction			
Site Work	30,054	30,054	43,054
Equipment	11,842	11,842	11,842
Construction	147,194	157,893	137,892
Contingency			65,204
Total, Construction	189,090	199,789	257,992
Total Estimated Cost	**220,701**	**231,400**	**292,300**
Contingency, TEC	*0*	*0*	*65,204*
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	2,189	2,189	2,189
Conceptual Design	0	0	0
Other OPC Costs	54,716	50,411	63,686
Contingency	0	0	35,825
Total, OPC	**56,905**	**52,600**	**101,700**
Contingency, OPC	*0*	*0*	*35,825*
Total Project Cost	**277,606**[a]	**284,000**	**394,000**
Total Contingency (TEC+OPC)	***0***	***0***	***101,029***

[a] The CD-4 TPC value was approved at $284,000,000. The project is currently in financial closeout and final TPC will be updated to reflect the final TPC when this process is complete. The tables reflect the current cost to date of $277,606,000.

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	79,501	46,657	N/A
Contingency	49,639	78,154	N/A
Total, Design	129,140	124,811	N/A
Construction			
Site Work	700	0	N/A
Long Lead Equipment	118,000	0	N/A
Construction	307,373	413,851	N/A
Contingency	35,200	0	N/A
Total, Construction	461,273	413,851	N/A
Other TEC (if any)			
Cold Startup	0	0	N/A
Contingency	0	0	N/A
Total, Other TEC	0	0	N/A
Total Estimated Cost	**590,413**	**538,662**	**N/A**
Contingency, TEC	*84,839*	*78,154*	
Other Project Cost (OPC)			
OPC D&D			
OPC D&D	35,280	54,000	N/A
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	0	0	N/A
Conceptual Design	0	0	N/A
Other OPC Costs	98,630	146,098	N/A
Contingency	19,726	10,435	N/A
Total, OPC	**153,636**	**210,533**	N/A

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Contingency, OPC	*19,726*	*10,435*	N/A
Total Project Cost	**744,049**	**749,195**	N/A
Total Contingency (TEC+OPC)[a]	***104,565***	***88,589***	N/A

RLUOB Hazard Category 3 (RC3) (04-D-125-07)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	69,499	44,000	N/A
Contingency	45,149	20,170	N/A
Total, Design	114,648	64,170	N/A
Construction			
Site Work	900	0	N/A
Equipment/Construction	245,467	226,475	N/A
Other, as needed	0	0	N/A
Contingency	27,847	46,751	N/A
Total, Construction	274,214	273,226	N/A
Other TEC (if any)			N/A
Cold Startup	0	0	N/A
Contingency	0	0	N/A
Total, Other TEC	0	0	N/A
Total Estimated Cost	**388,862**	**337,396**	N/A
Contingency, TEC	*72,996*	*66,921*	
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	0	0	N/A
Conceptual Design	0	0	N/A
Other OPC Costs	82,452	68,859	N/A
Contingency	41,105	48,867	N/A

[a] The high end of the current cost range the subproject was increased to reflect the completion of PEI1and REI2 subprojects and application of the underruns to the existing scope. The underruns are being used/made available to address existing scope as performance baselines are established. Until a performance baseline for all scope elements of the project is achieved, the project will maintain the top end of the range established at CD-1.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total, OPC	**123,557**	**117,726**	N/A
Contingency, OPC	*41,105*	*48,867*	N/A
Total Project Cost	**512,419**	**455,122**	N/A
Total Contingency (TEC+OPC)[a]	***114,101***	***115,788***	N/A

Total Project

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design			N/A
Contingency			N/A
Total, Design	768,413	713,273	N/A
Construction			N/A
Site Work			N/A
Equipment			N/A
Contingency			N/A
Total, Construction	1,588,807	1,580,202	N/A
Other TEC (if any)			N/A
Cold Startup			N/A
Contingency			N/A
Total, Other TEC			N/A
Total Estimated Cost	**2,357,220**	2,293,475	N/A
Contingency, TEC	*157,783*	*115,870*	N/A
Other Project Cost (OPC)			N/A
OPC D&D			N/A
OPC D&D	35,280	54,000	N/A
OPC except D&D	493,730	532,120	N/A
Total, OPC	**529,010**	**586,120**	N/A
Contingency, OPC	*60,831*	*41,299*	N/A

[a] The high end of the current cost range the subproject was increased to reflect the completion of PEI1and REI2 subprojects and application of the underruns to the existing scope. The underruns are being used/made available to address existing scope as performance baselines are established. Until a performance baseline for all scope elements of the project is achieved, the project will maintain the top end of the range established at CD-1.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Project Cost	2,886,230	2,886,230	N/A
Total Contingency (TEC+OPC)	***218,614***	***157,169***	*N/A*

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY2021	FY2022	FY2023	FY 2024	FY 2025	FY2026	FY2027	FY2028	Total
FY 2018	**TEC**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	OPC	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TPC	**1,955,230**	**274,000**	**289,000**	**0**	**0**	**0**	**0**	**0**	**359,000**	**2,877,230**
FY 2019	**TEC**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	OPC	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TPC	**1,954,230**	**274,006**	**285,000**	**0**	**0**	**0**	**0**	**0**	**363,994**	**2,877,230**
FY 2020	**TEC**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	OPC	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TPC	**1,851,936**	**39,817**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,891,753**
FY 2021	**TEC**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	OPC	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TPC	**1,870,503**	**169,427**	**238,123**	**113,655**	**275,841**	**198,477**	**11,204**	**0**	**0**	**2,877,230**
FY 2022	**TEC**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	OPC	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TPC	**1,889,937**	**169,427**	**138,123**	**0**	**0**	**0**	**0**	**0**	**688,743**	**2,886,230**
FY 2023	**TEC**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	OPC	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TPC[a]	**1,892,214**	**169,427**	**138,123**	**162,012**	**248,917**	**167,867**	**0**	**0**	**0**	**2,778,560**

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy[b]	3Q FY 2022
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	3QFY2072

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	25	25	1,250	1,250

[a] Funding is appropriated as TEC and converted to OPCs as necessary.

[b] Start date tied to anticipated programmatic operation of RLUOB as a hazard category 3 facility. Individual portions of CMRR project will have different completion dates and life spans.

7. D&D Information

The scope parameters established at CD-1 provided necessary Site Infrastructure Improvements (office facilities, physical security, warehouse, material staging and laydown area, access control and change rooms, etc.) to support AC/MC mission relocation, and to enable increased construction capacity, risk mitigation, and project efficiency. These activities will include an increase in site square footage and the D&D of equipment within existing facilities. The D&D of existing facilities is not funded on this project.

CMR D&D is not part of the CMRR project scope. Some removal of contaminated equipment in PF-4 for space reuse will occur using project funds.

Gross Square Footage Created/Eliminated	RLUOB/ REI1 Square Feet	REI2/PEI1 Square Feet	RC3/PEI2 Square Feet
New area constructed previously by this project at Los Alamos National Laboratory………………………………………………………………………….	225,757	50,000	127,500
Area of D&D in this project at Los Alamos National Laboratory ………..	0	0	0
Area at Los Alamos National Laboratory to be transferred, sold, and/or D&D outside the project including area previously "banked"………………………………………………………………………………………	225,757	50,000	127,500
Area of D&D in this project at other sites ………………………………………	0	0	0
Area at other sites to be transferred, sold, and/or D&D outside the project including area previously "banked"………………………………………………………………………………………	0	0	0
Total area eliminated ……………………………………………………………………….	0	0	0

8. Acquisition Approach

The CMRR Acquisition Strategy is based on procurement strategies specific for each subproject of the CMRR project in order to mitigate overall technical and schedule risk. The RLUOB subproject was executed via LANL-issued design-build subcontract based on performance specifications developed during CMRR Conceptual Design. The REI subproject was executed via LANL-issued final design-bid build construction contracts. The REI2 subproject is being executed via LANL-issued final design-bid-build construction contracts. The PEI1 subproject was executed via LANL-issued final design, and the construction was self-performed in the PF-4. The PEI2 subproject will be executed via LANL-issued design subcontracts, and construction will be self-performed in the PF-4. Construction work external to PF-4 will be executed through construction subcontracts. The RC3 subproject will be executed via LANL-issued design subcontracts, and construction will be self-performed in RLUOB. Construction external to RLUOB will be executed through design/build subcontracts. The performance baselines for each baselined subproject have been/will be established upon completion of 90% design maturity to allow development of credible cost estimates in accordance with DOE O 413.3B and NNSA policy.

Stockpile Research, Technology, and Engineering

Overview

The Stockpile Research, Technology, and Engineering (SRT&E) program provides the knowledge and expertise needed to maintain confidence in the nuclear stockpile without additional nuclear explosive testing.

The subprograms are:

1. Assessment Science
2. Engineering and Integrated Assessments
3. Inertial Confinement Fusion
4. Advanced Simulation and Computing
5. Weapon Technology and Manufacturing Maturation
6. Academic Programs

The Stockpile Research, Technology, and Engineering program:

1. Provides the scientific foundation for science-based stockpile decisions; the capabilities, tools, and components to enable assessment and certification; and balances the most pressing investments needed to meet Department of Defense (DoD) warhead requirements and schedules with the critical long-term research and development needed for a robust and responsive future stockpile.
2. Pursues Critical Decision-4 in Fiscal Year (FY) 2027 for the Advanced Sources and Detectors Major Item of Equipment for the Enhanced Capabilities for Subcritical Experiments (ECSE) program. This is to meet the W80-4 design validation experiment as well as W87-1 program requirements for system certification with a subcritical experiment.
3. Delivers the Advanced Simulation and Computing (ASC) Commodity Technology System-2 (CTS-2) platforms and Crossroads Phase 1 high performance computing (HPC) system for annual assessment, modernization programs, and safety and surety assessments in FY 2022; and finalizes deployment of improved ASC software environment and computing infrastructure in FY 2022 as preparation for the El Capitan system delivery in FY 2023.
4. Delivers modern technologies to enhance secure manufacturing capabilities and provide timely support of the stockpile, such as increasing Technology (TRL)and Manufacturing Readiness Levels (MRL) with reduced systems costs.
5. Develops the next generation of highly-trained technical workers to support the National Nuclear Security Administration (NNSA) core mission and strong academic partnerships with technical peers capable of providing peer review and scientific competition.

Line-Item Construction and Major Items of Equipment

SRT&E line-item construction projects and line-item purchases are critical to revitalizing the SRT&E and program-specific capabilities that directly support the nuclear weapons programs. The FY 2023 President's Budget for the U1a Complex Enhancements Project (UCEP) is $53,130,000. UCEP will perform mining and provide the supporting structures, systems, and components necessary to deploy large Major Items of Equipment (MIE) diagnostic systems and experiments. The enhancements to the U1a Complex included in this line item will provide the drifts and the supporting structures, systems, and components necessary for the deployment of the MIEs to diagnose the subcritical hydrodynamic integral weapons experiments using plutonium. The FY 2023 President's Budget for the Advanced Sources and Detectors (ASD) Major Item of Equipment (MIE) is $247,065,000. The ASD MIE installs a linear induction accelerator into the U1a Complex. The ASD MIE will provide the capability to conduct weapons-scale, radiographically diagnosed subcritical experiments using special nuclear material.

50 U.S. Code 2746 requires that if the estimated cost of completing conceptual design for a construction project exceeds $5,000,000, the Secretary shall submit to Congress a request for funds for the conceptual design before submitting a request for funds for the construction project. NNSA anticipates that the estimated cost to complete the conceptual design for the Combined Radiation Effects for Survivability Testing (CREST) at SNL will exceed the $5,000,000 threshold. The rough order of magnitude cost estimate to complete the conceptual design is between $60,000,000 and $140,000,000. Conceptual design for the CREST project is funded in the Weapons Survivability program.

Stockpile Research, Technology, and Engineering
Funding (Comparable)

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Stockpile Research, Technology, and Engineering					
Assessment Science					
Primary Assessment Technologies	150,000	150,000	154,507	+4,507	+3.0%
Dynamic Materials Properties	130,981	130,981	124,366	-6,615	-5.1%
Advanced Diagnostics	35,989	35,989	31,064	-4,925	-13.7%
Secondary Assessment Technologies	84,000	84,000	72,104	-11,896	-14.2%
Enhanced Capabilities for Subcritical Experiments	215,579	215,579	277,225	+61,646	+28.6%
Hydrodynamic and Subcritical Experiment Execution Support	152,845	152,845	142,402	-10,443	-6.8%
17-D-640, U1a Complex Enhancements Project, NNSS	160,600	160,600	53,130	-107,470	-66.9%
Total, Assessmment Science	**929,994**	**929,994**	**854,798**	**-75,196**	**-8.1%**
Engineering and Integrated Assessments					
Archiving and Support	45,760	45,760	43,950	-1,810	-4.0%
Delivery Environments	39,235	39,235	37,674	-1,561	-4.0%
Weapons Survivability	59,500	59,500	93,303	+33,803	+56.8%
Studies and Assessments	0	0	5,000	+5,000	0
Aging and Lifetimes	62,260	62,260	59,682	-2,578	-4.1%
Stockpile Responsiveness	70,000	70,000	68,742	-1,258	-1.8%
Advanced Certification and Qualification	60,649	60,649	58,104	-2,545	-4.2%
Total, Engineering and Integrated Assessments	**337,404**	**337,404**	**366,455**	**+29,051**	**+8.6%**
Inertial Confinement Fusion	**575,000**	**575,000**	**544,095**	**-30,905**	**-5.4%**
Advanced Simulation and Computing					
Advanced Simulation and Computing	732,014	732,014	742,646	+10,632	+1.5%
18-D-620, Exascale Computing Facility Modernization Project, LLNL	29,200	29,200	0	-29,200	-100.0%
Total, Advanced Simulation and Computing	**761,214**	**761,214**	**742,646**	**-18,568**	**-2.4%**
Weapon Technology and Manufacturing Maturation					
Surety Technologies	54,365	54,365	51,497	-2,868	-5.3%
Weapon Technology Development	131,692	131,692	121,330	-10,362	-7.9%
Advanced Manufacturing Development	111,908	111,908	113,338	+1,430	+1.3%
Total, Weapon Technology and Manufacturing Maturation	**297,965**	**297,965**	**286,165**	**-11,800**	**-4.0%**
Academic Programs	**101,912**	**101,912**	**100,499**	**-1,413**	-1.4%
Total, Stockpile Research, Technology, and Engineering	**3,003,489**	**3,003,489**	**2,894,658**	**-108,831**	**-3.6%**

Stockpile Research, Technology, and Engineering
Outyear Funding

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Stockpile Research, Technology, and Engineering				
Assessment Science				
Primary Assessment Technologies	160,905	171,138	170,614	173,767
Dynamic Materials Properties	128,777	131,482	134,243	137,062
Advanced Diagnostics	35,200	36,500	33,210	33,907
Secondary Assessment Technologies	75,006	76,581	78,273	79,917
Enhanced Capabilities for Subcritial Experiments	272,300	180,000	115,256	113,604
Hydrodynamic and Subcritical Experiment Execution Support	146,410	148,443	148,245	151,358
17-D-640, U1a Complex Enhancements Project, NNSS	129,870	0	0	0
Total, Assessmment Science	**948,468**	**744,144**	**679,841**	**689,615**
Engineering and Integrated Assessments				
Archiving and Support	44,881	44,875	44,819	45,769
Delivery Environments	38,453	38,447	38,397	39,208
Weapons Survivability	88,517	59,002	39,248	43,434
Studies and Assessments	5,000	5,000	5,000	5,105
Aging and Lifetimes	60,781	60,813	60,742	62,035
Stockpile Responsiveness	70,000	70,000	70,000	71,470
Advanced Certification and Qualification	59,234	59,229	59,160	60,417
25-D-XXX, Combined Radiation Effects Survivability Testing, SNL	0	97,000	164,000	212,000
Total, Engineering and Integrated Assessments	**366,866**	**434,366**	**481,366**	**539,438**
Inertial Confinement Fusion	**549,701**	**549,701**	**549,701**	**561,245**
Advanced Simulation and Computing				
Advanced Simulation and Computing	753,794	753,795	753,795	769,415
18-D-620, Exascale Computing Facility Modernization Project, LLNL	0	0	0	0
Total, Advanced Simulation and Computing	**753,794**	**753,795**	**753,795**	**769,415**
Weapon Technology and Manufacturing Maturation				
Surety Technologies	50,446	51,619	51,619	52,703
Weapon Technology Development	150,468	153,333	138,323	130,072
Advanced Manufacturing Development	144,524	146,196	131,196	123,741
Total, Weapon Technology and Manufacturing Maturation	**345,438**	**351,148**	**321,138**	**306,516**
Academic Programs	**102,526**	**104,576**	**106,667**	**108,801**
Total, Stockpile Research, Technology, and Engineering	**3,066,793**	**2,937,730**	**2,892,508**	**2,975,030**

Stockpile Research, Technology, and Engineering
Funding (Non-Comparable)

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Stockpile Research, Technology, and Engineering					
Assessment Science					
Primary Assessment Technologies	150,000	150,000	154,507	+4,507	+3.0%
Dynamic Materials Properties	130,981	130,981	124,366	-6,615	-5.1%
Advanced Diagnostics	35,989	35,989	31,064	-4,925	-13.7%
Secondary Assessment Technologies	84,000	84,000	72,104	-11,896	-14.2%
Enhanced Capabilities for Subcritical Experiments	215,579	215,579	277,225	+61,646	+28.6%
Hydrodynamic and Subcritical Experiment Execution	152,845	152,845	142,402	-10,443	-6.8%
17-D-640, U1a Complex Enhancements Project, NNSS	0	0	53,130	+53,130	0
Total, Assessmment Science	**769,394**	**769,394**	**854,798**	**+85,404**	**+11.1%**
Engineering and Integrated Assessments					
Archiving and Support	45,760	45,760	43,950	-1,810	-4.0%
Delivery Environments	39,235	39,235	37,674	-1,561	-4.0%
Weapons Survivability	59,500	59,500	93,303	+33,803	+56.8%
Studies and Assessments	0	0	5,000	+5,000	0
Aging and Lifetimes	62,260	62,260	59,682	-2,578	-4.1%
Stockpile Responsiveness	70,000	70,000	68,742	-1,258	-1.8%
Advanced Certification and Qualification	60,649	60,649	58,104	-2,545	-4.2%
Total, Engineering and Integrated Assessments	**337,404**	**337,404**	**366,455**	**+29,051**	**+8.6%**
Inertial Confinement Fusion	**575,000**	**575,000**	**544,095**	**-30,905**	**-5.4%**
Advanced Simulation and Computing					
Advanced Simulation and Computing	732,014	732,014	742,646	+10,632	+1.5%
18-D-620, Exascale Computing Facility Modernization	0	0	0	0	0
Total, Advanced Simulation and Computing	**732,014**	**732,014**	**742,646**	**+10,632**	**+1.5%**
Weapon Technology and Manufacturing Maturation					
Surety Technologies	54,365	54,365	51,497	-2,868	-5.3%
Weapon Technology Development	131,692	131,692	121,330	-10,362	-7.9%
Advanced Manufacturing Development	111,908	111,908	113,338	+1,430	+1.3%
Total, Weapon Technology and Manufacturing Maturation	**297,965**	**297,965**	**286,165**	**-11,800**	**-4.0%**
Academic Programs	**101,912**	**101,912**	**100,499**	**-1,413**	**-1.4%**
Total, Stockpile Research, Technology, and Engineering	**2,813,689**	**2,813,689**	**2,894,658**	**+80,969**	**+2.9%**

Stockpile Research, Technology, and Engineering
Outyear Funding

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Stockpile Research, Technology, and Engineering				
Assessment Science				
Primary Assessment Technologies	160,905	171,138	170,614	173,767
Dynamic Materials Properties	128,777	131,482	134,243	137,062
Advanced Diagnostics	35,200	36,500	33,210	33,907
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17-D-640, U1a Complex Enhancements Project, NNSS	129,870	0	0	0
Total, Assessmment Science	**948,468**	**744,144**	**679,841**	**689,615**
Engineering and Integrated Assessments				
Archiving and Support	44,881	44,875	44,819	45,769
Delivery Environments	38,453	38,447	38,397	39,208
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Stockpile Responsiveness	70,000	70,000	70,000	71,470
Advanced Certification and Qualification	59,234	59,229	59,160	60,417
25-D-XXX, Combined Radiation Effects Survivability Testing, SNL	0	97,000	164,000	212,000
Total, Engineering and Integrated Assessments	**366,866**	**434,366**	**481,366**	**539,438**
Inertial Confinement Fusion	**549,701**	**549,701**	**549,701**	**561,245**
Advanced Simulation and Computing				
Advanced Simulation and Computing	753,794	753,795	753,795	769,415
18-D-620, Exascale Computing Facility Modernization Project, LLNL	0	0	0	0
Total, Advanced Simulation and Computing	**753,794**	**753,795**	**753,795**	**769,415**
Weapon Technology and Manufacturing Maturation				
Surety Technologies	50,446	51,619	51,619	52,703
Weapon Technology Development	150,468	153,333	138,323	130,072
Advanced Manufacturing Development	144,524	146,196	131,196	123,741
Total, Weapon Technology and Manufacturing Maturation	**345,438**	**351,148**	**321,138**	**306,516**
Academic Programs	**102,526**	**104,576**	**106,667**	**108,801**
Total, Stockpile Research, Technology, and Engineering	**3,066,793**	**2,937,730**	**2,892,508**	**2,975,030**

Stockpile Research, Technology, and Engineering
Explanation of Major Changes
(Dollars in Thousands)

	FY 2023 Request vs FY 2021 Enacted ($)
Stockpile Research, Technology, and Engineering	
Assessment Science: The decrease is driven by reduced funding needs for U1a Complex Enhancements which is partially offset by increases to support burn studies for boost science and analysis as well as ECSE procurements.	**-75,196**
Engineering and Integrated Assessments: The increase reflects $23,500,000 in conceptual design costs in support of the planned line-item project Combined Radiation Environments for Survivability Testing (CREST) facility executed by the Weapon Survivability program. The increased funding for CREST is partially offset by shifting resources from all Engineering and Integrated Assessments programs to support higher priority NNSA efforts. The increase also includes restoration of funding for Studies and Assessments to support pre-Phase X/6.X studies and feasibility assessments of future nuclear weapon stockpile requirements.	**+29,051**
Inertial Confinement Fusion: The decrease prioritizes support for maturing experimental platforms to execute High Energy Density (HED) experiments critical to supporting stockpile needs, including the generation of intense sources of x-rays and neutrons for survivability studies and the development of high-fidelity approaches to experimentally characterize materials at high pressure.	**-30,905**
Advanced Simulation and Computing: The overall decrease is due to the planned conclusion of funding for the Exascale Computing Facility Modernization project.	**-18,568**
Weapon Technology and Manufacturing Maturation: The decrease reflects a transfer of quality assurance scope and funding from Weapon Technology Development to Stockpile Management/Production Operations, the transfer of direct cast scope and funding from Advanced Manufacturing Development to NA-19 Production Modernization, and the shift of resources from the three Weapon Technology and Manufacturing Maturation programs to support higher priority NNSA efforts.	**-11,800**
Academic Programs: The decrease reflects the reprioritization in SSAA Centers' focus as well as the plan to continue support of existing awards until completion.	**-1,413**
Total, Stockpile Research, Technology, and Engineering	**-108,831**

Stockpile Research, Technology, and Engineering
Assessment Science

Overview

The Assessment Science program provides the knowledge and expertise needed to maintain confidence in the nuclear stockpile in the absence of nuclear explosive testing. Capabilities developed and maintained in the Assessment Science program support the entire Nuclear Weapons Complex providing: (1) the scientific underpinnings required to conduct annual assessments of weapon performance and certification of life extension programs (LEPs); (2) the scientific insight to inform our understanding of the impacts of surveillance findings to ensure that the nuclear stockpile remains safe, secure, and effective; and (3) the core technical expertise required to be responsive to technical developments and geopolitical drivers. Assessment Science also facilitates the assessment of current weapon and weapon component lifetimes, the development and qualification of modern materials and manufacturing processes, the exploration of concepts for component reuse, and the development of modern safety concepts for sustainment.

Assessment Science performs experiments to obtain the materials and nuclear data required to validate and understand the physics of nuclear weapons performance. These include hydrodynamic and subcritical experiments to obtain data on the dynamic behavior of plutonium and surrogate materials in integral geometries. Science program experiments and data analyses also facilitate safety, security, and evaluations of sustainment concepts without the need for additional nuclear explosive testing. These activities develop, exercise, and maintain the expertise and competence of the nuclear weapon design, engineering, and assessment community. This compendium of weapons-relevant data is acquired using unique, small- and large-scale experimental facilities throughout the Department of Energy (DOE) nuclear security enterprise.

Many of the signature efforts enabling science-based stockpile stewardship at NNSA reside in this program. For example:

- Dynamic high- and low-Z (Z pulsed power facility) material experiments
- Hydrodynamic and subcritical experiments [Dual Axis Radiographic Hydrodynamic Test (DARHT), Contained Firing Facility (CFF), U1a Complex, proton radiography (pRad) capability at Los Alamos Neutron Science Center (LANSCE)]
- Enhanced Capabilities for Subcritical Experiments (U1a Complex)
- HED experiments [National Ignition Facility (NIF), Z, Omega Laser Facility (Omega)]
- Hostile environment experiments (Z, NIF)

While the research, development, platform deployment, and experimental execution support associated with these efforts resides in Assessment Science, the operational funds for the facilities are included in other program budgets, such as Inertial Confinement Fusion (ICF) and Infrastructure and Operations.

The Assessment Science program has strong programmatic coupling with the ASC, ICF, Engineering and Integrated Assessments, Weapon Technology and Manufacturing Maturation, and Stockpile Management programs. These program linkages and several crucial cross-cutting, scientific milestones (or pegposts) are captured in the Stewardship Capability Delivery Schedule (SCDS), a long-range communication, integration, and alignment tool that spans science-based stockpile stewardship activities within NNSA.

The Assessment Science program is made up of six subprograms:

1. **Primary Assessment Technologies** provides capabilities essential for annual assessment of stockpile primaries, improvement of the nuclear explosive test modeling suite in the common model framework, certification of future sustainment programs, improvements in primary safety and security, and resolution of Significant Finding Investigations (SFIs).
2. **Dynamic Materials Properties** develops and maintains the experimental capabilities needed to inform modern, physics-based models that describe and predict the behavior of weapon materials in extreme pressure, temperature, and strain rates to understand fundamental material behavior.
3. **Advanced Diagnostics** establishes revolutionary tools for delivering stockpile data by developing x-ray radiography and other diagnostics for future hydrodynamic, subcritical, and other experiments that subject materials to strong shocks and high strain rates.
4. **Secondary Assessment Technologies** provides capabilities that increase confidence in the assessment of stockpile secondaries. This is done by validating weapons physics models using experimental platforms, improving models,

expanding the nuclear explosive test modeling suite in the common model framework, and supporting evaluation of new manufacturing processes, replacement materials, and aged materials in the stockpile.

5. **Enhanced Capabilities for Subcritical Experiments** establishes a key test capability and closes a capability gap to evaluate the response of plutonium to aging, modern manufacturing techniques, modern materials, and evolving design philosophies. It also enables design certification of nuclear systems without the need for nuclear testing.
6. **Hydrodynamic and Subcritical Execution Support** provides the facilities and services required to maintain a robust testing capability that supplies critical data to weapon physicists and design engineers. These data allow assessments of potential impacts on weapon performance and safety due to design changes, material substitutions, or component changes associated with LEPs, alterations (Alts), or modifications (Mods).

Assessment Science
Primary Assessment Technologies

Description

Primary Assessment Technologies (PAT) provides capabilities essential for the annual assessment of stockpile primaries, certification of future sustainment programs, improvements in primary safety and security, and resolution of SFIs. Primary assessment efforts are focused on improving stockpile stewardship science predictive ability by testing and revising the common framework models to quantify uncertainties. The main objective is to stress these predictions to better quantify performance and confidence in qualification. The predictive models will also include the impact caused by design variance issues, aging effects (time progression decay), and/or variability of manufacturing processes on primary performance. As part of the effort to characterize primary performance, subcritical experiments will incorporate these factors (variance in engineering design, aging effects, and variability in manufacturing processes) to better quantify isolated effects in focused experiments and coupled/correlated effects in integral experiments. The principal focus area of PAT is improving predictive capabilities for modeling boost and a specific task for PAT is preliminary examination of pit reuse options to meet requirements. PAT also provides science capabilities used for Intelligence Community assessments of foreign-state nuclear weapon activities that concomitantly provide critical weapon design skills, training, and experimental opportunities and challenges for designers and engineers.

Between 2023 and 2025, PAT will be the lead for the 2025 *Advanced Understanding of Primary Performance* pegpost that will lead to better quantification of performance metrics and their uncertainties. This will incorporate improved boost models, plutonium aging data, and the impact of manufacturing variances.

Activities include: (1) design and analysis of hydrodynamic experiments to include subcritical experiments (SCE); (2) experiments supporting burn studies for boost science; (3) Integrated performance and analysis focused on primary's design, construction, and function; (4) nuclear science measurements (e.g., fission cross-sections, fission yield, etc.); and (5) surface science experiments to assess corrosion phenomena.

Highlights of the FY 2023 Budget

- Support the design, assembly, and analysis of multiple SCEs to understand plutonium aging, as well as impacts of modifications and changes in materials (in support of ALTs, MODs, LEPs).
- Support the development and use of platforms (Z, NIF, pRad) to enhance modeling and simulation efforts for the primary portion of the nuclear explosive package (NEP). These experiments are critical to validating our weapons physics models. The experimental validation enables increased confidence in weapon performance through reduced uncertainties.
- Support the re-establishment of plutonium experimentation capability at the Los Alamos Neutron Science Center (LANSCE) pRad, which provides critical dynamic performance data for materials and components (new alloys, new manufacturing and processing, and aging studies). Plutonium at proton Radiography (Pu at pRad) will allow cost-effective and quick turn-around experiments in support of integral experiments at Nevada National Security Site (NNSS).

FY 2024 – FY 2027 Key Milestones

- Complete Stewardship Capability Delivery Schedule (SCDS) Level 1 – Advanced Understanding of Primary Performance.
- Perform an analysis of alternatives for the future of the Sandia Boost platform utilizing the knowledge gained from performing the first full containment experiment for Boost platform in FY 2025.
- Execute the first Pu experiment at pRad.
- Field the combined environment Majesty test series.
- Develop a multiprobe diagnostic approach to quantify ejecta mass.
- Prepare Enhanced Capabilities for Subcritical Experiments (ECSE) by providing Sherman Pre-shot Physics Report.
- Evaluate Shallow Bubble Collapse (SBC) for several design types.
- Design proposal for a Flex shot (or series) studying SBC in integral geometries.
- Report on the measurement and evaluation of inelastic scattering for actinide and non-actinide isotopes in support of Survivability and ECSE.

FY 2021 Accomplishments

- Completed first covariance analysis for a “2E” fission product yield measurement using previously collected fission [Time Projection Chamber (TPC)] data. A 2E measurement provided independent (pre-beta-decay) yields, but with low resolution (~5 mass units). Data was useful in fission product data evaluations and highlighted the utility of fission-TPC experiments beyond cross sections.
- Evaluated capability of models in hydrocodes to simulate interfacial mixing. Analyzed a data set from Z of interfacial mixing of shocks launched into a beryllium rod seeded with multi-mode perturbations. Hydrodynamic simulations agreed during single-shock stage but diverged from the data at the time of reshock and later in time, indicating the need for more accurate models of such mixing in convergent geometry in the codes.
- The Pu at pRad project completed the third series of high explosive tests on the inner plutonium confinement vessel (IPCV) design. The test series included 125% over-pressure experiments, both with and without fragment mitigation in the IPCV. The IPCV will next be qualified for the experimental physics package that is planned for the first Pu at pRad experimental campaign.
- Demonstrated the effect of plasma heterogeneity on bulk thermonuclear rates as part of the Marble High Energy Density (HED) campaign. Marble is a unique separated reactants mix campaign to understand the interplay between mix and thermonuclear burn. These data enable the validation of mix and burn models in LANL multi-physics simulation codes.
- Preliminary analysis of fission TPC U-235 & U-238 data for fission product yields (FPY) and Total Kinetic Energy (TKE) performed by university collaborators.
- Saturn Scythe-2 provided data for optimization and performance of the Asay foil diagnostic in support of the Nimble SCE.
- New capabilities have been developed in ion implantation to produce samples for aging studies.
- Implemented x-ray diffraction capability on Z, as part of continued collaboration on Montrose platform for targets, diagnostics, and modeling/simulation with successful initial proof-of-concept run. Obtained time-gated x-ray diffraction patterns in Chama chamber with novel Diffraction Scintillator Optic (DISCO) scheme. DISCO holds promise for eventual use to assess phase changes in Special Nuclear Material on Z. The Montrose platform examines the early stages of the primary materials to elucidate the primary yield in a modern designed weapon.

Primary Assessment Technologies
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Primary Assessment Technologies $150,000,000	**Primary Assessment Technologies $154,507,000**	**Primary Assessment Technologies +$4,507,000**
• Designed and assembled experimental devices for the Nimble SCE series at U1a to advance our understanding of ejecta physics to inform material and manufacturing choices relevant to future LEPs. • Conducted analysis on the complete Red Sage-Nightshade SCE series to validate new physics-based models of ejecta. • Conducted experiments (2nd Flex shot, Los Alamos National Laboratory (LANL) - Sandia National Laboratories (SNL) collaboration) in support of boost science to improve the current understanding of primary performance via platforms for testing weapons design alterations. • Pu at pRad: Began hardware fabrication for IPCV final design for Pu experiments; deploy new ejecta physics diagnostics; Field High Pressure Hydrodynamics (HiPHy) implosion experiments, all to run more cost-effective, focused hydro experiments on Pu, rather than as SCE. • Improved models for boost metrics through application of Deep Machine Learning, advanced radiographic analysis methods, and modeling vaporization in codes, all to better model boost.	• Conduct proof of concept Montrose experiment and prepare samples for future experiments. • Conduct buildout of Durandal SCE device to include test hydro shots (establish confidence). • Conduct plasma transport experiments on various materials. • Evaluate and validate advanced ejecta physics models that include impact of defects, particle drag, and chemistry effects based on recent experimental results. • Deliver Final Results from Chi Nu for Major Actinides to be used by simulation and evaluation for annual assessments. • Conduct preliminary Pu at pRad on small scale Pu samples with intent to ensure containment and diagnostic calibrations.	• Increase in pace of subcritical experiments in preparation for ECSE, NDSE platforms coming on-line. • Conducting experiments in support of design and production requirements for certification and validation for two LEPs .

Assessment Science
Dynamic Materials Properties

Description

The Dynamic Materials Properties (DMP) subprogram develops and maintains the experimental capabilities to inform modern, physics-based models. The models describe and predict the behavior of weapon materials in environments of extreme conditions of pressure, temperature, and strain rates to understand how fundamental material behavior (core DMP) impacts nuclear weapon performance. They do not fully evaluate weapons performance. The consideration of pit and secondary component reuse and replacement also requires studies of degradation of materials with age (to include aged plutonium samples) under dynamic conditions to understand potential performance changes. This subprogram provides the experimental data and assessment of Special Nuclear Material (SNM), metals, conventional/insensitive high explosives (CHE/IHE), polymers, and foams under dynamic conditions required for annual assessment and certification of the stockpile as well as for future sustainment options. Aspects of this subprogram link to other programs/subprograms (including coordination of efforts) within DOE/NNSA including Physics and Engineering Models (PEM), Aging and Lifetimes, Advanced Manufacturing Development, Plutonium Modernization, High Explosives and Energetics, DOE/Office of Science, and the Department of Defense (Joint DoD/DOE Munitions Program (JMP)). DMP provides much of the experimental results that the National Plutonium Aging Plan and 10-year integrated program plan for Plutonium and Pit Aging.

Research pursued in DMP supports (1) the annual assessment process, (2) baselining of materials properties for the future determination of aging effects (e.g., Pu aging), and (3) consideration of materials replacement and future options for sustainment programs. The characterization of new materials and processes for stockpile applications is an emerging focus for stockpile modernization and responsiveness to enable the use of modern manufacturing techniques. New experimental capabilities are developed to provide the required data for annual assessment and potential future sustainment options. Additionally, DMP will lead a Stewardship Capability Delivery Schedule (SCDS) pegpost in FY 2023 on “Enabling Efficient and Flexible Pit Production.”

The following capabilities are being developed to facilitate certification of pit reuse with insensitive high explosives (IHE) for upcoming sustainment programs: (1) heating and cooling capabilities on dynamic testing platforms, (2) high pressure experiments on plutonium and other relevant materials, and (3) experiments on aged samples on various experimental platforms. Facilities and drivers to support experimental execution include NIF, Z, Joint Actinide Shock Physics Experimental Research (JASPER), TA-55 gas gun, High Explosives Applications Facility (HEAF), Dynamic Equations-of-State Facility (DEOS), Shock Thermodynamic Applied Research Facility (STAR), Dynamic Integrated Compression Experimental (DICE) Facility, High Pressure – Collaborative Access Team (HP-CAT), and the Dynamic Compression Sector (DCS). Additionally, for long-term certification needs, DMP is exploring alternatives that include expanding x-ray light sources (e.g., Advanced Photon Source (APS)) to characterize high Z materials and high explosives *in situ* within appropriate physical regimes. DMP is evaluating long pulse laser requirements to field at an x-ray-free electron laser (XFEL) to complement high pressure materials research at the APS.

DMP activities include: (1) experimental execution (e.g., equation of state) on high Z materials (including actinides), (2) experiments of low Z materials (including polymers, foams, etc.), (3) experiments to qualify high explosives and energetics, (4) development of high pressure platforms and x-ray light sources to access and characterize materials at extreme conditions, and (5) advanced materials research that includes novel synthesis/formulation and processing methodologies leading to future manufacturing advances.

Highlights of the FY 2023 Budget

- Prioritize properties of aged Pu and replacement materials to increase confidence in stockpile performance and LEPs.
- Emphasize tri-lab strength efforts (unifying the analytic models and multiple data sets for incorporation into simulations) in metals to provide more robust multi-phase equations of state to increase reliability of models.
- Maintain and enhance capabilities on high pressure platforms to expand pressure, temperature, and strain rate regimes for high interest materials.
- Develop new molecules and methodologies for scale-up of candidate IHE to provide better performing and more efficiently produced HE.

- Use x-ray light sources to develop new methodologies of examining high interest materials (e.g., metals, HE, additively manufactured materials) under extreme conditions, leading to advanced models with reduced uncertainties.
- Collaborate across Weapons Activities in areas such as plutonium aging, pit production, and high explosives to provide weapons designers with materials options.
- Support SCDS pegpost on "Enabling Efficient and Flexible Pit Production" in FY 2023.

FY 2024 – FY 2027 Key Milestones

- Continue execution of experiments in support of the National Plutonium Aging Strategy.
- Develop HE material options for the future stockpile, including new energetic molecules/formulations.
- Complete high Z shock ramp compression experiment at NIF up to terapascal pressure to validate and discriminate between EOS models.
- Execute first diffraction experiments in containment geometry on high Z metals, providing the data necessary for multiphase equations of state.

FY 2021 Accomplishments

- Delivered plutonium data and supported facility operations on JASPER, Z, and TA-55 to validate the plutonium equation-of-state (EOS) and plutonium aging models directly relevant to stockpile assessments, stockpile certification, and future stockpile options including the B61-12 LEP and W87-1 MOD programs.
- Performed the first Design for Manufacturing/Production science experiments on samples with high impurities, and sample surface defects supporting the SCDS pegpost in FY 2023. The experiments included characterization of material properties and gas gun testing.
- Executed and analyzed a JASPER shock experiment on accelerated aged Pu greater than 200 years in equivalent age. JASPER continues to develop new shock-release and temperature measurement platforms, uniquely capable of measuring stockpile-relevant Pu samples to assess aging and manufacturing issues.
- Delivered performance qualification data on conventional high explosives (CHE) lots supporting LEPs to inform reactive burn models for the current and future stockpile.
- Performed the first stripline Pu shot on Z, achieving record pressure. The capability enables high peak pressure experiments with high accuracy measurements. This type of data is important for assessments and executing LEPs and ALTs. Sandia and Los Alamos executed two Z experiments probing potential changes in plutonium compressibility with age.
- In coordination with other research and development (R&D) subprograms, produced integrated Plutonium and Pit aging program plan to be delivered to Congress.
- Reached ultrahigh static pressure in uranium experiments at High-Pressure Collaborative Access Team (HPCAT) using new capabilities for classified work via support from Argonne National Laboratory, the DOE Office of Science, and NNSA.
- Performed pyrometry experiments at TA-55 gas gun. The data set will be utilized for validation of equation of state models.
- Delivered dilatometry measurements of plutonium samples, which offer an opportunity to validate competing theories on plutonium aging.

Dynamic Materials Properties
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Dynamic Materials Properties $130,981,000	**Dynamic Materials Properties $124,366,000**	**Dynamic Materials Properties -$6,615,000**
• Conducted first experiments at Argonne's Advanced Photon Source (APS) under new classified operations model for future exploration of questions related to material aging and production science. • Performed Multi-phase strength experiments on metals to support development of multi-phase strength models over wide range of weapons-relevant strain rates including new platform at PF-4 and new techniques at APS to reduce uncertainties in physics modeling. • Pursued production science efforts in support of pit production including chemistry, defects, and casting. • Developed and matured several high explosive options for the future stockpile. • Conducted shock ramp and shock release experiments on plutonium at JASPER using 40 mm barrel in support of material aging. • Executed high pressure ramp compression, strength, and diffraction experiments at NIF using new and engineering aged Pu samples to validate models and reduce uncertainties in physics modeling. • Used HE pilot plant at LLNL to create batches of promising new IHE molecules and characterize performance. • Additional pre-heating capabilities for Pu Experiments on Z-machine; improved containment to enable higher pressures on Z-	• Support operations and experiments at JASPER for the plutonium aging program and provide system availability for certification programs. • Execute experiments in support of National Plutonium Aging Plan on various platforms. • Support FY 2023 Enabling Efficient and Flexible Pit Production with a series of quasi-static experiments to assess the role of impurities on materials properties. • Perform Tiny Stripline Pu experiments with >60% increase in peak pressure as compared to those conducted in FY 2021. • Execute experiments with plutonium on NIF TARDIS platform. • Provide update on tri-lab strength effort with multiphase strength data, including strength data from NIF, TA-55, and Z. • Apply advanced diamond anvil cell capabilities to expand pressure-temperatures conditions and expand to execution on actinides. • Perform EOS measurements of advanced aged plutonium on JASPER. • Execute dynamic experiments on additively manufactured polymer lattices at 3rd generation light sources.	• Decrease represents a reprioritization of resources to support higher priority NNSA programmatic efforts while supporting the highest-priority operations at JASPER and TA-55 gas gun. Supports requisite plutonium shots on Z. • Decreased support for classified experimental capability at Argonne's Advanced Photon Source and development on light sources upgrade collaborations with the DOE Office of Science.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
machine; enabled access to weapons-relevant regimes to inform physics modeling.		

Assessment Science
Advanced Diagnostics

Description

The Advanced Diagnostics (AD) subprogram establishes revolutionary tools for delivering stockpile data by developing dynamic experiment diagnostics and advanced next-generation drivers for future hydrodynamic, subcritical, and other experiments. Requirements for new stockpile data are based on recommendations from the weapons design program elements at the Los Alamos and Lawrence Livermore National Laboratories (LANL and LLNL); by the weapons system stewardship activities, including life extension programs (LEPs); and by other subprograms in ICF and Assessment Science Programs.

Priority activities across the AD program include the continued development of the diagnostics, drivers, and methodologies to support the varying needs of the Weapons Program for intermediate- and long-term experiments. These revolutionary technologies motivate new materials models with innovation and design optimization, validate models used in modern design codes, and advance and improve the quality of the scientific results obtained at the experimental facilities.

Efforts to advance drivers include work in traditional pulsed power engineering, R&D for energy storage, power flow and current adder; solid state pulsed power technologies; and application of lasers to produce extreme environments. The development and implementation of new diagnostics for subcritical, fundamental, and focused experiments include photon, particle, and neutron detectors; visible light cameras; position, velocity, and temperature (“shock wave”) diagnostics; advanced (non-x-ray) radiographic techniques such as proton and neutron radiography; and soft x-ray imaging. Methodological improvements for weapons experiments include new techniques for hydrodynamic and subcritical experiments and short-pulse laser driven electron and ion beam sources.

These revolutionary technologies improve the quality and reliability of scientific results at many NNSA experimental facilities at the national security laboratories and sites. These include the Dual Axis Radiographic Hydrodynamic Test (DARHT), the flash x-ray machine (FXR) at the Contained Firing Facility, Z, Cygnus at the U1a Complex, and the pRad at the Los Alamos Neutron Science Center (LANSCE).

Highlights of the FY 2023 Budget

- Design and test a quarter-scale pulser prototype with modulation and increased energy storage. This activity is a part of the overall maturation of the technologies to enable cinematographic radiography. Cinematographic radiography would support capturing a larger number of frames at a near-arbitrary frame rate of the time-evolution of a system under study, and in conjunction with hydrodynamic and subcritical experiments, provide a robust test of the predictive capability of weapons design codes and help reduce the need for nuclear explosive testing.
- Continue multi-year effort to mature compact pulsed power and component-level technologies. High peak pulsed power technology could be applied to multiple, future applications such as next-generation accelerator architecture for combined environments, neutron reactivity source, high flux neutron radiography source, and future programmable waveform driver to explore properties of dynamic materials.
- Execute power flow physics and electrode conditioning experiments on Z and Mykonos and continue power flow modeling and simulation work. If this work proves successful, it will solve a 50-year problem that is unavoidable with this type of accelerator system and provide revolutionary advances in preventing energy loss in current and future systems.
- Research and develop next-generation, novel diagnostics and methodologies for fundamental, focused, and integral experiments, including hydrodynamic and subcritical experiments, and evaluate the role that deep machine learning may play in analyzing and fusing radiographic and other data from dynamic experiments. These next-generation technologies and analytical techniques can significantly impact the development and validation of new models by exploring new regimes or conditions not accessible with current diagnostics or data analysis methods, delivering greater quantity and higher quality of data.

FY 2024 – FY 2027 Key Milestones

- Research and develop next-generation driver technologies that create physical environments needed to anticipate the long-term requirements of the Weapons Program.
- Mature and build prototype technologies for cinematographic radiography for future hydrodynamic and subcritical experiments to provide a robust test of the predictive capability of weapons design codes and help reduce the need for nuclear explosive testing.
- Advance revolutionary radiography and other diagnostics as well as modernize data analysis techniques and models to increase learning from dynamic experiments (e.g., surrogate and plutonium experiments supporting stockpile assessments and LEP developments) through delivery of high-fidelity data, which may provide a better test of current codes, reducing the need for nuclear explosive testing.
- Establish dynamic neutron radiography, which utilizes an intense, pulsed neutron source, as a primary diagnostic system at CFF to support fundamental understanding of how plutonium aging and manufacturing variances affect performance, radiographic and reactivity measurements, and assurance of stockpile survivability.

FY 2021 Accomplishments

- Commissioned plasma discharge cleaning to treat electrode contaminants on the Mykonos pulsed power facility in support of a FY 2021 program milestone. Contaminants lead to current loss in these types of accelerator systems and their mitigation could be one way to increase coupled energy.
- Obtained power flow spectroscopy data, which indicates the presence of higher electrode plasma densities than previously expected in the Z inner magnetically insulated transmission line. Understanding power flow in current systems improves confidence that current loss can be mitigated in a next-generation high current machine.
- Successfully accelerated the first electron beams with bipolar solid state pulsed power through active reset induction cells on FXR at the CFF. This establishes the technology has matured to a high TRL, a significant step toward enabling cinematographic x-ray radiography.
- Demonstrated first atomic ejecta data using a novel optical probe diagnostic on a shock-driven platform at Special Technologies Laboratory (STL).
- Completed the Radiographic Futures Study, concentrating on fundamental and focused experiments. This study guides next-generation radiography development, especially since radiography continues to be a key diagnostic for weapon physics experiments. These next-generation technologies and techniques significantly impact the development and validation of new models of materials and of physical processes by exploring new regimes and conditions not accessible with current diagnostics and through highly sensitive measurements.
- Completed conceptual design for a new diagnostic approach combining multi-pulse x-ray material density measurements along with optical shadowgraphs. Demonstrated ejecta imaging with two-wavelength visible shadowgraphs. New techniques were created to constrain particle size estimates in plutonium ejecta experiments.
- Completed design of a Kraken eight-frame camera concept utilizing a 2x2 imaging sensor array, which can be used in next-generation multi-pulse radiography and visible imaging experiments and represents a technology solution for Enhanced Capabilities for Subcritical Experiments imaging using the Scorpius x-ray machine.
- Performed modeling and data analysis for several new diagnostics systems. Created high resolution detector response functions for the Ross filter detector array, a diagnostic that will improve density measurements and reduce accelerator performance risk for subcritical experiments. Modeled lutetium yttrium oxyorthosilicate (LYSO) and bixbyite transparent ceramic (GLO) scintillators to characterize radiation blur as a function of scintillator thickness and combined with data analysis to better inform radiographic configuration selection for subcritical experiments.

Advanced Diagnostics
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Advanced Diagnostics $35,989,000	**Advanced Diagnostics $31,064,000**	**Advanced Diagnostics -$4,925,000**
• Developed conceptual designs for technologies enabling cinematographic radiography, which could provide high fidelity data for hydrodynamic and subcritical experiments. • Completed power flow experiments for physics model validation and evaluate improvements from plasma discharge cleaning technology. These efforts may help solve energy losses on large, pulsed power platforms. • Increased maturity of compact pulsed power and component-level technologies. One application could be to create nuclear weapon-like conditions for assessing the future stockpile without the need to return to nuclear explosive testing. • Completed a Radiographic Futures Study for promising approaches to long term radiography to guide development. • Researched and developed next-generation diagnostics, radiography, and source technologies in support of the current and future stockpile, which could provide vital weapons data and code validation supporting assessments and certification. • Developed and improved modeling, simulation, and analysis, which could help reduce measurement uncertainties and ensure better quality data from experiments.	• Design and test a quarter-scale pulser prototype, an activity that supports cinematographic radiography, which could provide high fidelity data for hydrodynamic and subcritical experiments. • Continue multi-year effort to mature compact pulsed power and component-level technologies, which could be used to create nuclear weapon-like conditions for assessing the future stockpile. • Execute power flow physics and electrode conditioning experiments and continue power flow modeling and simulation work, advancing understanding in energy loss prevention in current and future systems. • Research and develop next-generation diagnostics and methodologies for fundamental, focused, and integral experiments, which can significantly impact the validation of new models by exploring new regimes not accessible with current technologies, delivering better quality and quantity of data. • Continue to improve modeling/analysis methods (such as those using machine learning), which could help reduce measurement uncertainties and ensure better quality data from experiments.	• Decrease represents a reprioritization of resources to support higher priority NNSA programmatic efforts while supporting the highest-priority diagnostic and pulsed power driver activities .

Assessment Science
Secondary Assessment Technologies

Description

The Secondary Assessment Technologies (SAT) subprogram provides capabilities that increase confidence in the assessment of stockpile secondaries, enabling a broad range of sustainment options and resolution of SFIs. A principal focus of SAT is to provide the experimental and science capability used to quantify full system performance margins and associated uncertainties. The subprogram uses historical nuclear explosive test data and conducts and utilizes a variety of above ground experiments to obtain new data and to develop and validate physical models. These efforts expand the domain of valid modeling tools and qualified experimental platforms to meet the needs of life extension and modernization programs, enabling responsiveness. Key elements include primary output, radiation transport, complex hydrodynamics and burn, material properties, and weapons outputs and effects. For stockpile systems, secondary assessment facilitates (1) the reacceptance of existing secondaries and other nuclear explosive package components for future sustainment options and (2) the development of the science basis for qualification methodology for physics performance of remanufactured canned sub-assembly (CSA) and other components. Secondary Assessment Technologies will continue efforts from FY 2021 and FY 2022 in support of the physics qualification of direct cast DU manufacturing, the development of current special materials options and alternate materials for secondaries, and underwrite aging mitigation physics and manufacturing options. Using High Energy Density (HED) and non-HED qualified platforms, SAT will evaluate and assess alternate materials of interest for the future stockpile and production modernization.

The subprogram validates the weapons physics models supporting the LEPs and modernization programs, anticipates stockpile responsiveness needs, develops new experimental platforms, continues model improvements, and expands the nuclear explosive test modeling suite in the common model framework. Efforts to evaluate new manufacturing processes, replacement materials, and aged materials in the stockpile and to evaluate their impact on stockpile performance are essential to the LEPs and weapon and production modernization programs. Understanding the impact of manufacturing processes for the production and restoration of CSA components requires both experimental measurements and modeling techniques to address performance impacts. Efforts will continue to develop HED platforms that produce sources to be used in support of weapon outputs, effects, and performance in hostile environments. The capability to address survivability in a hostile environment requires understanding weapon outputs, propagation of outputs, and the subsequent effects coupling into the weapon intended for survival and how the performance of the weapon is impacted. SAT research supporting these goals includes obtaining experimental data supporting weapon design code validation for more accurate weapon output calculations, improving laboratory radiation sources and diagnostics to support code validation and hardware qualification experiments, and developing platforms for evaluating candidates and evolving stockpile technologies for radiation hardness.

SAT has strong programmatic coupling with PAT, ICF, Engineering and Integrated Assessments, Weapon Technology and Manufacturing Maturation, and ASC. SAT has significant coupling to advanced computing platforms and resources supported by the ASC program and to the Weapons Survivability and Aging & Lifetimes subprograms in the Engineering and Integrated Assessments program. SAT partners with Secondary Capability Modernization in executing experiments and relevant analyses supporting physics and engineering qualification of new materials and processes needed for the modernization of stockpile secondaries.

Highlights of the FY 2023 Budget

- Continue efforts in support of direct cast depleted uranium manufacturing as well as physics and engineering qualification of alternate and special materials to mitigate risk for the modernization programs.
- Execute initial technology maturation activities and support physics qualification for manufacturing options to mitigate aging.
- Expand the weapon science validation basis using studies of relevant nuclear explosive test data, off-nominal and non-stockpile designs, supporting stockpile assessments, and LEP and modernization decisions.
- Compare opacity data from experiments and theory through national effort at Z, NIF, and Orion; do cross-platform and code comparisons, develop hypotheses for discrepancies and future directions for resolving them.

- Develop platforms and execute experiments in both HED and non-HED venues that inform modeling capability, stockpile sustainment and modernization.
- Continue to apply and advance x-ray environments at HED facilities to meet pegpost deliverables and support stockpile decisions.
- Continue to develop combined environment platforms and study source scaling.

FY 2024 – FY 2027 Key Milestones
- Continue to advance material development initiatives and new manufacturing options for a more responsive and manufacturable stockpile.
- Complete inter-laboratory calibration project using historic samples.
- Expand the Underground Test (UGT) suite with off-nominal and non-stockpile designs to establish validation basis for more responsive, manufacturable design options and to address secondary relevant issues and support assessments and resolution of SFIs.
- Apply statistical methods to specific physics relevant to secondary performance to inform what experiments may best constrain performance of an untested secondary.
- Develop and qualify new HED and non-HED platforms to deliver constraining data, improve and validate models, and anticipate needs of the modernization programs.
- Advance x-ray environments and deliver threat-relevant sources needed to qualify options for threat mitigation/hostile survivability, including testing at higher levels of integration.

FY 2021 Accomplishments
- Executed a broad range of experiments for model validation, material development, and fundamental physics understanding. Completed FY 2021 Stewardship Capability Delivery Schedule (SCDS) pegpost supporting physics and engineering qualification for direct cast depleted uranium with Secondary Capability Modernization.
- Advanced a material processing technique and demonstrated capability for a special material in support of stockpile modernization needs, in support of FY 2022 SCDS Special Materials pegpost.
- Completed modeling and analysis of non-stockpile devices to inform aging induced features and completed initial research and development on a viable advanced manufacturing option in support of FY 2022 SCDS Assess Lifetimes & Mitigate Aging pegpost.
- Developed HED platforms and executed and analyzed HED experiments for Verification & Validation (V&V) simulation toolkits, in support of stockpile science. Demonstrated highest radiation temperature on a NIF platform for future applications, advanced high atomic-weight equation-of-state (EOS) measurements at high pressures, measured EOS of relevant materials to compare with EOS models, collecting final data set at different experimental configurations to constrain the drive and enable uncertainty quantification (UQ). Completed qualification of a scaled complex hydro HED platform. Acquired additional data on co-propagating shocks, obtaining validation data for modeling complex hydrodynamic behavior using a new multi-diagnostic capability; stood up a parallel experimental campaign on the OMEGA EP Laser System that provides supporting data. Achieved simultaneous radiograph and burn-through measurements on a platform designed to assess the impact of radiation on evolving interfaces to inform rad-hydro models.
- Initiated the first set of historical sample exchange, chemical analysis, and preliminary measurement comparisons for an inter-laboratory LANL/LLNL collaboration effort.
- Utilized Direct Numerical Simulations (DNS) to study the degree to which high resolution simulations accurately capture detailed behavior for a set of classical problems. This information can be used to assess existing modeling capability for laboratory experiments.
- Incorporated additional models into existing codes to support experiments to be executed on the European X-ray Free Electron Laser.
- Demonstrated proof-of-principle for high precision measurements of gamma-ray branching ratios in the beta decay of long-lived fission products. Decay branching ratio measurements of fission products are important to stockpile stewardship applications and evaluations of fission product yields.
- Made significant progress in opacity, a key property in weapons performance simulations. Continued advances in target design, reductions in background noise, spectrometer modifications and improved analyses demonstrated

enhanced fidelity of NIF measurements. In addition, reserve funding provided the means to initiate a tri-lab development of a time-dependent spectrometer for NIF opacity.

- Advanced unique time-resolved absorption spectra measurements on Z using a hybrid-CMOS x-ray imager and added additional high atomic number opacity data set at Z, extending the systematic study needed to assess and improve the accuracy of opacity modeling. Achieved time-resolved temperature measurements to understand emission opacity at ~1keV and measured absolute x-ray emission spectroscopy on multiple samples concurrently in a dense, high temperature plasma, providing key constraints on plasma models.
- Continued to increase warm x-ray yield on Z using sources derived from ICF concepts and optimized for x-ray yield.
- Developed a multi-year, prioritized plan to achieve a combined uncertainty of <10% in x-ray power and yield for cold and warm x-ray sources on Z radiation effects science experiments for input with scaled spectra into response models and simulations.
- Measured thermomechanical shock response of material samples exposed to warm x-ray environments and recovered samples for microstructural analysis to support future stockpile decisions, supporting the FY 2021 SCDS pegpost on New Engineering Materials.

Secondary Assessment Technologies
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Secondary Assessment Technologies $84,000,000	**Secondary Assessment Technologies $72,104,000**	**Secondary Assessment Technologies -$11,896,000**
• Completed the FY 2021 SCDS pegpost on Direct Cast material, execute final set of experiments, complete analyses, and report results, with Secondary Capability Modernization. • Expanded weapon science validation basis using studies of relevant nuclear explosive test data and off-nominal and non-stockpile designs to advance the understanding of relevant physics processes, increase confidence, and support stockpile assessments and modernization. • Executed simulation studies and investigate CSA component repair, enabling refurbishment options supporting the FY 2022 SCDS Assess Lifetimes and Mitigate Aging pegpost. • Advanced platform design and diagnostic capabilities, and conduct experiments to address secondary performance physics questions including refining understanding of the impact of features on performance, radiation flow, opacity, and HED burn, reducing uncertainties and increase confidence in modeling. • Continued developing a low-energy-density platform enabling physics assessments to aid in LEP and production modernization efforts. • Experimentally informed nuclear models to improve cross-section evaluations of processes important for the interpretation of secondary performance and radiochemical activation	• Initiate efforts to develop alternate materials and to optimize casting of material of interest and investigate impact of impurities size and distribution on dynamic material behavior to support production modernization. • Continue maturation and physics qualification effort for manufacturing option developed as part of the FY 2022 SCDS Assess Lifetimes & Mitigate Aging pegpost. • Continue inter-laboratory calibration effort of extinct and long-lived isotopes using historic sample. Compare measurements made between laboratories, identify sources of inconsistencies, and determine path forward. • Continue to advance and qualify HED platforms, to address secondary performance physics questions and anticipate needs of the modernization programs. • Complete initial comparisons of experimental and theoretical opacity data of multiple elements acquired at NIF and Z and using multiple opacity codes. Develop hypotheses for discrepancies and future directions to resolve them. • Complete a comparison of weapon output predictions between alternate codes for a defined set of devices, assess prediction similarities and differences to guide modeled and reported uncertainties in weapon output.	• Decrease represents a reprioritization of resources to support higher priority NNSA programmatic efforts while supporting the highest-priority SAT activities. • Decrease reduces efforts on HED platform developments, non-stockpile design modeling, nuclear chemistry, new material and aging studies, and x-ray source development.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
measurements, reducing uncertainty and increasing confidence. • Delivered advanced warm x-ray sources for survivability assessments and the streamline outputs calculation capabilities to inform modernization efforts.	• Evaluate designs and experiments to increase x-ray yield at >20 keV and reduce uncertainties in x-ray power and yield from cold and warm x-ray sources at Z.	

Assessment Science
Enhanced Capabilities for Subcritical Experiments

Description

The stockpile is inherently moving away from the nuclear explosive test database through aggregate influences of aging, modern manufacturing techniques, modern materials, and evolving design philosophies. In 2014, LANL and LLNL jointly identified that a capability gap involving the evaluation of plutonium response exists, which frustrates certification of these changes. In 2016, the JASON Defense Advisory Group identified the same gap in current U.S. capability to carry out and diagnose such experiments; Enhanced Capabilities for Subcritical Experiments (ECSE) will close this gap. Data from ECSE is required as part of the certification of the W87-1 Modification program, as well as future Annual Assessments and LEPs. ECSE delivery in the mid-2020s supports these efforts.

Research has advanced the understanding of plutonium in the early evolution of an imploding system and identified the need to similarly improve understanding of plutonium performance during the extreme physical conditions reached later in an implosion. This improved understanding will inform the evaluation of various components of stockpile transformation and certification of planned LEPs not possible given the current limitations of existing facilities and diagnostic methods. In addition to the physics gap, the National Laboratories have identified a gap in experimental capabilities needed to develop the next generation of weapon designs in the absence of nuclear explosive testing. NNSA has validated this gap via the 2016 JASON study. To fill these gaps and to support the program plan documented in the Stockpile Stewardship and Management Plan (SSMP), NNSA places a high priority on developing ECSE at the Nevada National Security Site's (NNSS) underground laboratory, the U1a Complex.

The ECSE subprogram consolidates a portfolio of work that includes (1) the Major Item of Equipment (MIE) titled Advanced Sources and Detectors (ASD), (2) a developing reactivity measurement technology named Neutron Diagnosed Subcritical Experiments (NDSE), and (3) ECSE subcritical experiment entombment activities. Though managed by the ECSE subprogram, the construction project 17-D-640, U1a Complex Enhancements Project (UCEP) is funded as a separate line-item. Other Project Costs (OPCs) for the U1a Complex Enhancements Project are funded from the ECSE subprogram.

ASD, managed under DOE O 413.3B, designs and installs a large, multi-pulse accelerator system that will generate radiographs necessary to diagnose late-time dynamics in plutonium implosion experiments. ASD is scheduled to complete by the third quarter of 2027. NDSE is a measurement concept that NNSA will apply to dynamic plutonium experiments that will measure the negative reactivity of a subcritical assembly. Since neutron multiplication is sensitive to the material properties of fissile material, the data will provide a new constraint on the codes and models used to simulate the performance of nuclear weapon primaries, improving our stockpile assessment capability. Entombment activities provide a disposition area in the U1a Complex for expended subcritical experiments.

As outlined in the NNSA Stockpile Stewardship Management Plan, NNSA plans long-term investments supporting plutonium science at the NNSS. NNSS is the only site in the United States with the capability to perform experiments combining high explosives and plutonium in significant quantities, a core capability for NNSA's Stockpile Stewardship Program, as per 50 U.S. Code § 2521.

Highlights of the FY 2023 Budget

- Continues delivery of ECSE capabilities in support of the W80-4 confirmation experiment, the W87-1 program certification requirements, and future weapon system certification plans.
- Completes demolition, tunneling, and installation of support services for ECSE expended subcritical experiment entombments at the U1a Complex.
- Installs the Dense Plasma Focus, associated detector system, and diagnostics into the ZEUS Test Bed to support subcritical experiments that establishes a new capability in the U1a Complex to perform dynamic NDSE measurements in 6' diameter confinement vessels.
- Supports procurements, assembly, and testing of ASD components above ground needed prior to final installation into the U1a Complex.

FY 2024 – FY 2027 Key Milestones

- FY 2024 – Complete the U1a Complex ZEUS Test Bed in preparation for dynamic NDSE experiments.
- FY 2025 – Execute subcritical experiments in the U1a Complex ZEUS Test Bed using NDSE.
- FY 2026/2027 – Complete 17-D-640, U1a Complex Enhanced Capabilities project.
- FY 2026/2027 – Complete the ASD installation.
- FY 2027 – Execute subcritical experiments in the U1a Complex SCORPIUS Test Bed using ASD.

FY 2021 Accomplishments

- Completed Preliminary Design for ASD.
- Demonstrated the Solid-State Pulsed Power Technology in a U1a compatible footprint.
- Completed assembly of the dense plasma focus in the NNSS Area 11 facility (above ground) that will be used as the source for dynamic NDSE experiments in the U1a Complex ZEUS Test Bed.
- Started tunneling of the entombment area that will be used for expended subcritical experiments.
- Approved and started long lead procurements for ASD and UCEP.
- Started long lead procurements for U1a Complex ZEUS Test Bed.

Enhanced Capabilities for Subcritical Experiments
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Enhanced Capabilities for Subcritical Experiments $215,579,000	**Enhanced Capabilities for Subcritical Experiments $277,225,000**	**Enhanced Capabilities for Subcritical Experiments +$61,646,000**
• Approved ASD CD-3A to execute long lead procurements. • Continued and refined ASD design in conjunction with UCEP 020 design. • Optimized manufacturability of injector and accelerator cells. • Continued testing and characterization of the NDSE neutron source using a deuterium-tritium gas fill for future installation into the ZEUS Test Bed. • Completed design and started refurbishment of the ZEUS Test Bed to enable installation of the U1a NDSE system that consists of a DPF neutron source, large area gamma-ray detector, and shielding. • Started tunneling activities in the U1a Complex for expended subcritical experiment entombment.	• Continues delivery of ECSE capabilities in support of the W80-4 confirmation experiment, the W87-1 program certification requirements, and future weapon system certification plans. • Completes demolition, tunneling, and installation of support services for ECSE expended subcritical experiment entombments at the U1a Complex. • Installs the Dense Plasma Focus, associated detector system, and diagnostics into the ZEUS Test Bed to support subcritical experiments that establishes a new capability in the U1a Complex to perform dynamic NDSE measurements in 6' diameter confinement vessels. • Supports procurements, assembly, and testing of ASD components above ground needed prior to final installation into the U1a Complex.	• The Advanced Sources and Detectors Major Item of Equipment, a linear induction accelerator, will make large procurements post approval for construction. These procurements include parts for the injector and accelerator cells, solid state pulsed power units, beam transport, and the imaging system.

Assessment Science
Hydrodynamic and Subcritical Experiment Execution Support

Description
The Hydrodynamic and Subcritical Experiment Execution Support (HSEES) program maintains a robust testing capability to supply critical data to weapon physicists and design engineers, allowing assessment of potential impacts from design changes, material substitutions, or component changes associated with LEPs, Alts, or Mods on weapon performance safety. Experiments are used to assess the effects of component aging or defects identified during stockpile surveillance activities. The data obtained from these experiments are foundational for the annual assessment process, certification decisions, advancement of nuclear weapon science, refinement of weapon computational models, development of emergency response tools, assessment of foreign and terrorist designs, reducing the risk of technological surprise, and developing the skills and experience of weapon physicists and design engineers.

Individual programs determine the need for integral hydrodynamic experiments (hydros) and are responsible for the design, fabrication, and assembly of the test device as well as the post-experiment detailed data analysis that inform the physics models and weapon codes. The HSEES subprogram funds the fielding, diagnostics, execution, initial data analyses, and the disposition/cleanup of the expended hydro experiments. Many of the hydros are conducted in specialized steel containers (known as “impulsively loaded steel vessels”) that confine the high explosives and hazardous material byproducts. For surrogate material hydros (those experiments that do not contain special nuclear material), these vessels undergo a lengthy requalification process post-experiment that entails clean out, weld repair, and inspections. For plutonium experiments executed at the U1a Complex, also known as subcritical experiments, the vessels are entombed underground and removed from inventory.

Through interaction with the Department of Defense, the future nuclear weapon stockpile continues to evolve resulting in a high demand for hydro data from weapon physicists and design engineers. Surrogate hydros are conducted at LANL and LLNL facilities while subcritical experiments are conducted at the NNSS U1a Complex. Enhanced Capabilities for Subcritical Experiments will establish new test beds in the U1a Complex that will require HSEES funding post construction.

Highlights of the FY 2023 Budget
- Ensure the operational and diagnostic capabilities of the NNSA complex firing facilities are sufficient to execute hydrodynamic tests in support of specific weapon systems (LEP/ALT/MOD), nuclear weapon stockpile, global security, and experimental science.
- Procure, assemble, and field impulsively loaded steel vessels in support of integral weapon experiments hydrodynamic tests.
- Provide experimental diagnostics and hardware to firing sites such as DARHT, CFF/FXR, U1a Complex, BEEF, 851, DAF, R306, and Lower Slobbovia.

FY 2024 – FY 2027 Key Milestones
- Provide operational facilities, modern diagnostics, hardware, and personnel to support experiments associated with life extension programs, weapon modification programs, weapon alteration programs, significant finding investigations, the nuclear weapon stockpile, global security, and experimental science.

FY 2021 Accomplishments
- Performed experiments for the LEP/modernization programs, and SFI studies supporting the B61-12, W80-4, W87-1, W76 and global security.
- Improved operations efficiency by completing installation of the DARHT weather enclosure that allows weapon experiments to be executed without impact from weather events such as snow and lightning.
- Transitioned to digital high-speed acquisition of images (to replace the old film-based cameras) at site 300, which will save time and resources in not having to develop film.
- Developed the vessel supply chain by initiating design through a “first-article” fabrication where new vendors demonstrated the ability to meet the strict requirements for high explosive loaded vessel systems.

- Executed three subcritical experiments at the U1a Complex with multiple test packages of HE and Pu in each experiment to inform our models on stockpile performance.

Hydrodynamic and Subcritical Experiment Execution Support
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Hydrodynamic and Subcritical Experiment Execution Support $152,845,000	**Hydrodynamic and Subcritical Experiment Execution Support $142,402,000**	**Hydrodynamic and Subcritical Experiment Execution Support -$10,443,000**
• Executed hydrodynamic experiments essential to meet requirements for both the W80-4 and W87-1 programs. • Prepared for and support execution of initial experiments in the Nimble SCE series to inform material and manufacturing choices relevant to future life extension programs. • Facilitated the testing and commissioning of new accelerator technologies in support of hydrodynamic and subcritical experiments needs. • Procured 3' and 6' vessels required to support and execute NHP and SCE program schedules. • Completed Red Sage Series to validate new physics-based models of ejecta for stockpile stewardship applications. • Conducted dynamic Pu experiments at the DAF to better understand weapons performance. Prepared for Excalibur SCE series, which will be the first user of the Neutron Diagnosed Subcritical Experiments capability. • Maintained/updated DSA documentation in support of subcritical experiments.	• Execute hydrodynamic tests in support of LEPs, nuclear weapon stockpile, global security, and experimental science. • Ensure the operational capabilities of the NNSA complex firing point facilities and diagnostics in support of certification, surveillance, SFIs, lifetime extensions and modernization programs, and global security. • Procure, assemble, and field impulsively loaded steel vessels in support of integral weapon experiments hydrodynamic tests. • Provide experimental diagnostics and hardware to firing sites such as DARHT, CFF/FXR, U1a Complex, BEEF, 851, DAF, R306, and Lower Slobbovia.	• Decrease represents a reprioritization of resources to support higher priority NNSA programmatic efforts. • The decrease will limit execution of scheduled integrated experiments that produce data to improve weapons physics models and codes.

U1a Complex Enhancement Projects
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
17-D-640, U1a Complex Enhancements Projects, NNSS $160,000,000	***17-D-640, U1a Complex Enhancements Projects, NNSS $53,130,000***	***17-D-640, U1a Complex Enhancements Projects, NNSS -$107,470,000***
• This project was under Infrastructure and Operations.	• Continue construction of UCEP 020. See Construction Project Data Sheet for details.	• This is a programmed decrease. See Construction Project Data Sheet for details.

Stockpile Research, Technology, and Engineering
Engineering and Integrated Assessments

Overview

The Engineering and Integrated Assessments program is responsible for ensuring system diagnostic survivability in present and future stockpile-to-target sequences (STS) and ensures a responsive nuclear deterrent through collaborative partnerships, proactive integration, and assessments. This program supports four key mission areas: (1) strengthening the science, technology, and engineering base by maturing advanced technologies to improve future weapon systems; (2) providing tools for qualifying weapon components and certifying weapons without nuclear explosive testing; (3) supporting annual stockpile assessments through improved weapons surveillance technologies and warhead component aging assessments; and (4) providing capabilities that accelerate the nuclear weapons acquisition process and strengthen the ability of the United States to respond to unexpected developments that could threaten nuclear security.

Primary responsibilities of this program include:

- Assessing nuclear and non-nuclear components without nuclear explosive testing.
- Providing fundamental, sustained engineering research and development for stockpile assessment and certification throughout the lifecycle of each weapon.
- Providing the ability to experimentally represent environments and predict the response of weapon components and subsystems to those aging normal, abnormal, and hostile environments.
- Advancing components and materials testing processes to minimize destructive effects while ensuring high level weapon reliability and certification.
- Maintaining the capabilities to assess and evaluate new materials for insertion opportunities into life extension programs, major alterations, and other warhead modernization efforts.
- Developing and demonstrating capabilities to shorten design, certification, and manufacturing cycles to minimize time and costs leading to engineering prototype and production.
- Preserving historical knowledge, records, and data related to U.S. nuclear testing and stockpile stewardship efforts and making the archives useful for current and future stockpile stewards.
- Conducting multi-discipline studies to understand and assess future weapon concepts for the nuclear stockpile, to include engaging with the DoD to gather insight into their needs.

The Engineering and Integrated Assessments program is made up of seven subprograms:

1. **Archiving and Support** preserves and maintains historic knowledge, records, and data related to U.S nuclear weapons testing and Stockpile Stewardship, and provides targeted studies, multi-system assessments, and independent reviews that support the annual assessment of the stockpile.
2. **Delivery Environments** funds the development and application of experimental and modeling capabilities, diagnostics, and data used to evaluate weapon survivability through Normal and Abnormal Environments in current and future Stockpile to Target Sequences – e.g., reentry environments, atmospheric gliding, current and evolving thermal and pressure differentials, maneuvering, shock phenomena, and combined environments.
3. **Weapons Survivability** funds tools and technologies to ensure U.S. weapons will operate through hostile environments such as current and future enemy defenses.
4. **Studies and Assessments** funds pre-Phase 1/6.1 assessments, studies, and other activities, conducts program technical, cost, and feasibility assessments to inform NWC decision-makers of the strategic impacts from the pursuit of various nuclear security enterprise and weapon capabilities in coordination with USSTRATCOM and the Military Services.
5. **Aging and Lifetimes** funds scientific research to understand and mitigate the impacts of aging on materials and components in the stockpile, and develops diagnostics used to assess age-induced impacts on weapon systems.
6. **Stockpile Responsiveness** provides efforts that sustain, enhance, and exercise capabilities required to conceptualize, study, design, develop, engineer, certify, produce, and deploy nuclear weapons. These efforts do not include the actual production or deployment of a stockpile weapon system, nor do they engage in the acquisition of nuclear weapons for the U.S. stockpile.
7. **Advanced Certification and Qualification** funds tools and methods to ensure that there is a certification path for stockpile systems and new components in the absence of additional explosive nuclear testing. This is done by

integrating computing, science, technology, and engineering advancements to facilitate certification of future life extensions and other warhead needs.

Engineering and Integrated Assessments
Archiving and Support

Description
The Archiving and Support program is responsible for preserving and maintaining relevant historic records, data, and knowledge related to U.S. nuclear weapons testing and Stockpile Stewardship and providing targeted studies, independent reviews, and multi-system assessments that support the annual assessment process.

Archiving and Support activities include:
Archiving and Data Management (ADAM) – Preserves the historical knowledge, records, and data related to U.S. nuclear testing and Stockpile Stewardship efforts. ADAM ensures the continuity of data beyond the lifetime of its native formats. Additionally, ADAM provides access to the historical archives used across the nuclear security enterprise (NSE) by scientists and engineers. Data from the ADAM program is used to maintain and assess the current stockpile, support stockpile modernization, and train the next generation of weapons scientists and engineers.

Assessments and Targeted Studies (A/TS) – Provides multi-system assessments and analyses studies that support weapon certification and safety processes; physics and chemistry weapon assessments; and independent and cross laboratory weapon assessments. This effort also supports targeted studies, which are 1-to-2-year, short term evaluations that focus on specific gaps or results from an assessment.

Highlights of the FY 2023 Budget
The Archiving and Support program continues to directly support NNSA's three highest priorities to sustain the nuclear stockpile, recapitalize the infrastructure needed to support the stockpile, and ensure the workforce of the future.

- Ensures knowledge preservation to inform future stewardship activities:
  - Continues digitization of large holdings at Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), Nevada National Security Site (NNSS), and the Kansas City Nuclear Security Campus (KCNSC).
  - Collects and catalogs metadata on weapons-related documents, films, and other media.
  - Continues efforts to accelerate digitization of paper, films, microfilm, microfiche, aperture cards, and other media.
  - Maintains the U.S. Geological Survey (USGS) Core Library and Data Center.
  - Funds the Nuclear Testing Archives at Nevada, the National Security Research Center (NSRC) at Los Alamos, and the Livermore archives.
- Enables the Cycle 27 Annual Assessment for the nuclear stockpile:
  - Performs radiochemistry efforts for data analysis, full system modeling, engineering baseline analysis, and high explosive and special nuclear material physics studies.
  - Supports targeted stockpile studies and weapon-program agnostic research and development activities.
  - Performs the Independent Nuclear Weapons Assessment program (INWAP) for Cycle 26 (2021).
- Maintains and/or upgrades the capabilities that support Archiving and Support activities:
  - Funds computer upgrades and software licenses.
  - Funds Artificial Intelligence/Machine Learning (AI/ML) software development for archiving and data management.
  - Maintains seismic monitoring stations used to monitor and record seismic measurements of experimental explosions and subcritical experiments and provides verification monitoring data for the Comprehensive Nuclear-Test-Ban Treaty.
  - Upgrades and purchases new equipment used to digitize unique and critical archives dating back to the Manhattan Project.

FY 2024 – FY 2027 Key Milestones
- Expand the ADAM program by incorporating all NSE sites requiring digitization.
- Provide an NSE-wide, searchable database of archived materials.
- Establish inter-site relationships and processes to increase productivity.
- Apply advanced AI/ML to enhance digitization and search and recall capabilities.
- Fund a Nuclear Security Enterprise (NSE)-wide Titan Technologies: Compendia Data Platform license.

- Continue to support the Annual Assessment reporting process.
- Develop and demonstrate and understanding of weapon system concepts.
- Document the contributions of each long-term activity.

FY 2021 Accomplishments

- Executed contract with Titan vendor for both development and production licenses on the classified networks that will use AI/ML technologies to catalog and search the National Security Research Center's (NSRC) digital collections. Less than 10% of the NSRC's collections have been digitized and less than 10% of those digitized collections have been cataloged. Without this artificial intelligence/machine learning system to catalog and search the digitized collections, the digitized files are very difficult and sometimes impossible to find.
- Established the Rocky Flats Digitization Laboratory, the seventh high speed digitization lab at LANL.
- Hired new research librarians and historians to support continued improvement of the digitization and archiving activities for Weapons Program knowledge management. Implemented a digitizing equipment certification program to guarantee all staff know how to operate the new high-speed digitizing equipment and the relevant digitizing standards to use.
- Developed a graphical user interface at LLNL that enables access to a comprehensive archive of digitized films, reports, and data.
- Completed the final version of the Weapons Testing Ontology and the initial version of the Rocky Flats Ontology.
- Continued outreach and diversification programs at LLNL including the Neurodiversity Intern program and summer internships.
- Developed software to accelerate optical character recognition processing of geophysical well logs by a factor of 10.
- Developed Standard Operating Procedures at LLNL for selected workflow processes supporting the archiving "pipeline" to assure consistency.
- Completed installation of industry-standard equipment to increase scanning capacity and acceleration of digitization.
- Continued digitization and upload of Tonopah Test Range films into the Digital Media Archive at SNL.
- Archived core from underground tests were analyzed to explore the value of new diagnostic measurements to constrain weapon physics simulations.
- Continued collaboration between sites to increase productivity.
- Improved several key processes in digitization and document processing, as well as modeling and simulation tools that will benefit the development of program capabilities. Supported Cycle 26 Annual Assessment activities and completed all planned INWAP studies.
- Developed On the Job Training Animation software in LANL's Weapon Response group. This life-like animation matches exactly what a worker would see and do while assembling and disassembling a weapon system allowing workers to practice and develop muscle memory in a realistic situation, but one with no consequences if there is an error.
- Developed of a Computational Fluid Dynamics (CFD) capability at LANL.

Archiving and Support
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Archiving and Support $45,760,000	**Archiving and Support $43,950,000**	**Archiving and Support -$1,810,000**

• Supported Cycle 26 Annual Assessment activities; complete all planned Cycle 26 INWAP activities.
• Performed targeted studies identified in the Cycle 25 annual assessment for the nuclear stockpile.
• Continued to permanently archive critical weapon testing information to ensure availability for future stockpile stewards.
• Activities such as those listed below are key elements of this effort.
  ○ Continued acceleration and uploading of records into GRANTA.
  ○ Continued ongoing support of Engineering Analysis Baseline Models.
  ○ Continued film digitization efforts at LLNL.
  ○ Began preliminary investments in artificial intelligence and machine learning.
  ○ Supported ongoing digitization of paper, film, microfiche, microfilm, aperture cards, and other media.
  ○ Collected and catalog metadata.
  ○ Fund the USGS Core Library and Data Center and seismic monitoring stations.
  ○ Continued support for the Nuclear Testing Archives at Nevada and the
	• Support Cycle 28 Annual Assessment activities and complete all scheduled INWAP activities in accordance with the INWAP.
	• Identify and conduct targeted multi-system studies and assessments identified during the Cycle 27 Annual Assessment process.
	• Perform stockpile studies that improve physical models for assessments and improve modeling methodology.
	• Support development of physics baseline common model framework.
	• Support the Nuclear Testing Archives and the National Security Research Center (NSRC).
	• Support the Capabilities for Nuclear Intelligence (CNI) Practicum.
	• Perform ongoing digitization of paper, film, microfiche, microfilm, aperture cards, and other media and collect and catalog metadata.
	• Perform ongoing digitization of paper, film, microfiche, microfilm, aperture cards, and other media and collect and catalog metadata.
	• Continue analysis of archival test cores to generate new data used to support LEPs and Annual Assessment.
	• Continue acceleration efforts to increase digitization speed and efficiency.
	• Continue early investments in machine learning for metadata collection.
		• The decrease reflects a shift of resources to support higher priority NNSA efforts.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
National Security Research Center (NSRC) at Los Alamos. ○ Provided librarians at LANL and LLNL. ○ Funded computer licensing and equipment upgrades; purchase high end scanners and digitization equipment. ○ Provided M&O detail support at headquarters. • Revitalized radiochemical analyses of historical core samples by analyzing archival test cores to generate new data to support LEPs and Annual Assessment. • Supported the Test Capability Assessment, a framework and process to facilitate agile management of weapons test capabilities focused on stockpile demands. • Continued support of the U.S. Geological Survey, Seismic monitoring, risk reduction, and maintain compliance with Federal Facility Agreement and Consent Order (FFACO). • Engineering Support/IT/Personnel: Supported infrastructure and IT costs such as IT procurements, vault support, training, etc. • Obtained and maintained licenses for PDMLink, GRANTA, and ABACUS.	• Support digitization, storage, indexing, and librarian services relative to nuclear security materials. • Maintain electronic repositories for existing and new digitized nuclear security materials. • Capture legacy test data in GRANTA. • Maintain PDM Link, and Abacus licensing as needed to support multi-system assessment work and the archives. • Support the U.S. Geological Survey, seismic monitoring, risk reduction, and maintaining compliance with FFACO. • Maintain computer licensing and equipment upgrades; purchase digitization equipment to support acceleration activities. • Provide M&O detail support at headquarters. • Revitalize the radiochemical analyses of historical core samples by analyzing archival test cores to generate new data to address question of life extension programs (LEPs). • Support the next generation workforce through neurodiversity programs and internships. • Expand the workforce with highly trained field experts in library science and history.	

Engineering and Integrated Assessments
Delivery Environments

Description
The Delivery Environments (DE) program ensures delivery systems and platforms survive current and future Stockpile to Target Sequences (STSs) in *Normal* and *Abnormal* environments, such as reentry environments, atmospheric gliding, current and evolving thermal and pressure differentials, maneuvering, shock phenomena, and combined environments. Future delivery systems and platforms may be characterized by STSs different from those for the present stockpile. The Delivery Environments program identifies and reproduces weapon-relevant environments and develops the necessary modeling and simulation, diagnostics, and experimental capabilities to elucidate and quantitatively assess the survivability of delivery systems in mission environments.

Delivery Environments activities include:
Mission Flight – Design, analyze, and engineer normal-abnormal (environmental) survivability capabilities relevant to the Department of Defense's (DoD's) delivery systems to meet performance requirements during current and future Stockpile-to-Target Sequences. Select examples include the modeling and testing of shock, vibration, thermal stresses, pressure strains, adverse and normal effects, the combination of these environments with hostile or abnormal environments, and the effects of these phenomena on nuclear and non-nuclear weapon components and systems. This program works closely with the Weapons Survivability (WS) program, the Stockpile Responsiveness program (SRP), the Advanced Simulation and Computing (ASC) Office, and the Department of Defense and Intelligence Community to ensure informed decisions, prioritization, and resource optimization.

Abnormal Environments – Assess the survivability and effectiveness of a weapon system following accidents or unexpected adverse events that could impact performance. Select examples include drops during the handling and/or mounting of a weapon, crash and burn, bunker fires, aircraft crashes, and transportation accidents. This program collaborates with ASC to ensure experiments and predictive capabilities are jointly developed.

Current and Future Stockpile Components – In addition to considering future systems, the Delivery Environments program also focuses on qualified stockpile components and investigates the application of said components for future Stockpile-to-Target Sequences and related survivability requirements.

Highlights of the FY 2023 Budget
- Develop two prototypes for future delivery platforms and conduct preliminary tests for quantifying survivability margins with respect to future STS-informed requirements.
- Ensure confidence in future STS survivability by executing joint milestones to survey current experimental and computation tools and continuing a joint DOE/DoD roadmap to plan future capability investments. Engineer combined environment (i.e., combinations of normal, hostile, abnormal environments) weapon components and systems to meet emerging environmental challenges informed by the Department of Defense.
- Deliver jointly with ASC the FY 2023 Survivability for Reentry Environments Pegpost under the Stockpile Capability Delivery Schedule (SCDS).
- Conduct the sled-test experiment "Deep Core" at Holloman Air Force Base, in partnership with the Stockpile Responsiveness Program (SRP) and the Air Force. The effort is supported by LLNL and SNL.
- Begin coordinating the SCDS FY 2026 Combined Threat Environments Simulation Pegpost in partnership with the Weapons Survivability Program and ASC.

FY 2024 – FY 2027 Key Milestones
- Continue collaborations with the Stockpile Responsiveness program and the Air Force to execute a sled-test at Holloman Air Force Base as an initial step in designing, engineering, and testing future platforms and environments, and begin assessments of survivability margins.
- Deliver the SCDS FY 2026 Combined Threat Environments Simulation Pegpost in partnership with the Weapons Survivability Program and ASC, incorporating assessment capabilities across delivery and hostile environments.

FY 2021 Accomplishments

- Successfully completed the joint DoD/NNSA studies on delivery and threat environments supported in the FY 2020 NNSA/Air Force Research Laboratory (AFRL) Joint Milestone. The FY 2021 Joint Milestone continued these activities with the next stage in development and included partnerships with the Office of Advanced Simulation and Computing.
- Conducted a preliminary combined environments test in partnership with the Weapon Technology Development program. The test focused on combined acceleration, spin, and vibration on non-nuclear weapon components.
- Completed early-stage assessments from fluid-structure interaction measurements relevant to reentry environments.
- Executed uncertainty quantification and performed proof-of-concept tests in hypersonic wind tunnel.
- Completed first stage multi-system/multi-platform scrimmage studies and reentry computational predictive methods supporting prioritization of future delivery platform options.
- Finalized preliminary reentry computational predictive methods for future platforms and environments in preparation for validation. This work supported the FY 2021 Joint NNSA/AFRL Milestone.

Delivery Environments
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Delivery Environments $39,235,000	**Delivery Environments $37,674,000**	**Delivery Environments -$1,561,000**
• Engineered prototypes and subsystems for future weapons systems essential to understanding system performance in normal and abnormal environments – with some of this work impacting the W87-1, W80-4, and W93. • Performed combined environments experiments for higher confidence in safety assessment of behavior in abnormal environments. • Advanced two prototypes for future delivery platforms and conducted preliminary tests on future survivability requirements. • Revised and updated the joint roadmap with Department of Defense branches for future Stockpile-to-Target Sequence environment requirements. • Continued the joint Delivery Environments/Stockpile Responsiveness Program sled tests supporting future delivery platforms (LLNL & SNL CA partnership). • Integrated flight trajectory results from current mod/sim tests with engineering of future delivery prototype (LANL & SNL NM partnership). • Established combined environment (i.e., combinations of normal, and abnormal environments) engineering foundation to meet emerging environmental challenges informed by DoD.	• Deliver the FY 2023 Survivability for Reentry Environments Pegpost under the Stockpile Capability Delivery Schedule (SCDS). • Conduct the sled-test experiment – "Deep Core" – at Holloman Air Force Base, in partnership with the Stockpile Responsiveness Program (SRP) and the Air Force. The effort is supported by LLNL and SNL. • Conduct joint studies with the Air Force Research Laboratory and the Air Force Nuclear Weapons Center on reentry survivability predictive capabilities for advanced applications. • Begin coordinating the SCDS FY 2026 Combined Threat Environments Simulation Pegpost in partnership with the Weapons Survivability Program.	• The decrease reflects a shift of resources to support higher priority NNSA efforts.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
• Maintained and developed diagnostics for future Stockpile-to-Target Sequence measurements, analyses, and quantitative capability gaps.		

Description
Weapons Survivability provides the tools and technologies necessary for ensuring U.S. nuclear weapons will operate through hostile environments such as enemy defenses. Since weapons entering the stockpile are expected to be fielded for decades, Weapons Survivability includes projections for the evolution of defensive technologies.

Weapons Survivability scope includes: (1) developing scientific and engineering models for understanding radiation effects; (2) improving laboratory radiation sources and diagnostics to support code validation and hardware qualification experiments; (3) generating experimental data to validate scientific and engineering models; (4) understanding radiation-hardened design strategies; and (5) evaluating candidate and evolving stockpile technologies for radiation hardness capabilities in a generalized, weapon-relevant configuration.

Weapons Survivability activities include:
System-Generated Electro-Magnetic Pulse (SGEMP) and Electro-Magnetic Pulse (EMP) Effects – Several electromagnetic (EM) effects driven by x-rays, gamma, and high-power EM sources can induce detrimental responses to nuclear and non-nuclear electrical components of the warhead. A particular effect of concern is System Generated Electromagnetic Pulse (SGEMP), whereby photons with sufficient energy to penetrate and interact with materials inside the weapon produce energetic electrons generating large currents within the weapon. Cable SGEMP and Box Internal Electromagnetic Pulse (IEMP) are variations associated with cables and components. Understanding SGEMP (and its various counterparts, i.e., xEMP) requires knowledge of physical phenomena, including radiation transport across complex material interfaces; photo emission; radiation-induced conductivity in solids, foams, and gases; time-dependent dielectric breakdown phenomena; and EM coupling through plasmas. Importantly, the responses are highly dependent on the temporal and spectral content of the radiation drive, the properties of the materials undergoing irradiation, and the coupling between subsystems.

Related to this is the production of EMP environments driven in the atmosphere whereby x-rays and high energy gamma rays dissociate the atmosphere, produce conductivity, which drives currents and high frequency electromagnetic pulses. These environments can induce detrimental responses inside the weapon, depending on Reentry Vehicle/Reentry Body shielding effectiveness.

Presently, there are limited high fidelity experimental and test environments for driving relevant SGEMP/xEMP responses. Current and planned capabilities utilizing the Saturn and High Energy Radiation Megavolt Electron Source III (HERMES III) Accelerators, the National Ignition Facility (NIF), and Z cannot adequately support component, subsystem, or system-level testing for many of the xEMP effects, particularly those driven by x-rays. In the absence of suitable testing capabilities (e.g., adequate fluence, spectrum, volume, time history, etc.), this effort has a strong focus on developing experimental platforms for physics discovery and code validation to support computational capabilities that enable the qualification of components for x-ray driven EM effects while advancing present phenomena understanding for future applications. In addition, this effort develops the platforms and diagnostics for test and evaluation that allows creation of relevant high fidelity (real or surrogate) environments.

Effects of X-rays and Air Blast on Materials – This effort includes all activities related to material and structural responses driven by x-rays and air blast. The effort is relevant to the study of both exo-atmospheric nuclear burst encounters, as well as endo-atmospheric encounters. Structural effects and response from exposure to air blast can become significant for the terminal phase of flight. Limited high fidelity testing capabilities exist for analyzing and assessing these effects; for example, radiation testing is limited to small objects over a restricted range of photon energy. Mechanical surrogates are used in many cases for system- level qualification for both cold x-rays and air blast. Hence, validated modeling and simulation capabilities are vital to understanding these effects and validating the efficacy of the surrogate platforms. Select activities include direct testing of materials and components at radiation generating facilities, development of diagnostics and platforms to increase the applicability of these facilities, development of surrogate testing capabilities (e.g., explosive drives, intense particle beams or optical [intense laser] light), and development and validation of modeling and simulation capabilities based on modern codes. Key facilities of use include the Z, NIF, Light Initiated High Explosive Facility, and related gas-gun capabilities.

Neutron Effects – Neutron radiation from nearby nuclear bursts has the potential to cause damage to various warhead components. For endo-atmospheric engagements, neutrons can be effective at ranges that are large relative to the effective ranges of other radiation. Assessing the effects of neutron exposure to warhead components requires understanding these interactions over a significant range of energies and pulse shapes. Importantly, exo-atmospheric engagements require knowledge of high energy (14 mega-electron volts [MeV]) neutron effects.

This effort includes direct testing of materials and components along with developing corresponding modeling and simulation tools. Specific activities include: modeling and experiments to investigate fission heating, modeling to quantify the initiation response to external neutron fields, experiments and modeling to investigate displacement damage in semiconductors and other electronic effects, obtaining calibration data for neutron radiation aware micro-electronics models, facility and diagnostic development, material aging effects on neutron environment survivability development, and validation of modeling and simulation capability based on modern codes. Key facilities of use include Annular Core Research Reactor facility (ACRR) and NIF.

High Energy Photon Effects – This effort primarily focuses on the study of energy (dose) and power (dose rate) deposition in material, of high energy (i.e., > 1 MeV) photons. High energy photons can penetrate deep into the interior of a weapon and cause disruptions, error readouts, and burnout of critical electronics. This effort encompasses electrical component response to dose-rate effects; single electron effects, high energy photon transport in materials, radiation hardened micro-electronics design, and the study of long lifetime intrinsic radiation (INRAD) effects found within the warhead. The INRAD activity is primarily focused on the development of capability to characterize the INRAD environment and assess aging of critical components exposed to INRAD.

Weapon Output – A robust survivability capability relies upon the understanding and analyses of foreign weapon threats and their outputs. Until recently, legacy tools that were validated using underground test data were exclusively used. These legacy tools are reaching the end of their lives, so this effort supports the process for modernizing and improving tools and methodologies. Improved physics fidelity and hydrodynamics over longer simulation times is a cornerstone of this development. Validation of these new tools is necessary and will be accomplished using a combination of underground test data and above ground experiments. This is coupled with higher-fidelity diagnostics to enhance the calculated uncertainties associated with weapon output modeling.

Further, the propagation and quantification of uncertainties is paramount to understanding margins and providing certification assurances for survivability analysis. A robust understanding of survivability margins cannot be achieved without uncertainty quantification imbedded within the hostile threat characterization. This effort focuses on establishing a more comprehensive understanding of the required modeling fidelity based on understanding of weapon output uncertainty propagation in the mechanical and electrical response of components and systems, more transparent and functional databases, and improved visualization software.

Combined Environments – Legacy survivability analyses have generally been performed by separating and addressing individual effects, one at a time. As computational tools, diagnostics, and technology insertion have become more flexible and robust, assessments of combined environments are now possible. This effort focuses on the development of experimental facilities, including conceptual design for CREST, and platforms for combined environment testing (e.g., radiation + mechanical, radiation + EMP, etc.), combined effects response discovery and analysis, and analysis of effects at high levels of integration. It also supports the development and validation of modeling and simulation capabilities based on modern codes. Further, data generated with combined survivability assessments can be utilized to improve understanding of integrated weapon response, electrical response, and terminal flight dynamics of U.S. warheads after a hostile or fratricide engagement.

Highlights of the FY 2023 Budget

- Execute research and development and qualification capability development shots on high energy density (NIF and Z) and radiation environment (Saturn, Hermes, ACRR, etc.) machines and facilities.

- Develop laboratory weapon qualification platforms that reproduce the extreme environments characteristics of hostile nuclear encounters.
- Develop experimental capabilities for delivery systems that enable development of mitigation mechanisms capable of addressing current and future hostile threats.
- Provide experimental tools and advances in simulation capabilities to qualify the behavior of new electronics in radiation environments.
- Deliver the SCDS FY 2023 Hostile Mitigation pegpost.
- Continue efforts on CREST to address the programmatic and enterprise impacts from the aging ACRR facility and improve weapons survivability program capabilities. Execute conceptual design activities for CREST to achieve CD-1 in FY 2024, including development of architectural drawings, electrical and power distribution system layout, and design basis activities (e.g., operations, maintenance, security, and radiation protection requirements).

FY 2024 – FY 2027 Key Milestones

- Maintain and extend nuclear environment test capabilities at the Hermes, Saturn, Annular Core Research Reactor (ACRR), and the NIF.
- Achieve CREST CD-1 in FY 2024.
- Deliver modeling, simulation, and testing capabilities to support qualification of new components designed to mitigate modern and future hostile environments.
- Collaborate with Delivery Environments and Advanced Simulation and Computing programs on the SCDS FY 2026 Combined Threat Environments Simulation pegpost.

FY 2021 Accomplishments

- Delivered energetic neutron test platform for qualification and calibration of radiation response.
- Completed test layout and hardware build for high explosive experimental test campaign.
- Executed several experiments to gather data on x-ray interaction with samples of interest.
- Collaborated with designers to utilize advanced modeling and simulation tools to predict impact of combined radiation effects dose rate response of circuits and identify circuit devices that dominate the response.
- Conducted several experiments to study the thermomechanical shock response of materials exposed to warm x-ray environments.
- Exercised improved radiation transport code to investigate improved agreement between electrical effects and radiation shielding measurement and calculations.
- Redesigned sample holders to improve clamping efficiency and thermal isolation for neutron test campaign and began developing a follow experiment by assessing sealing and gas sampling of sample cells.
- Completed analysis of potential hostile effects on a component for a weapons system.

Weapons Survivability
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Weapons Survivability $59,500,000	**Weapons Survivability $93,303,000**	**Weapons Survivability +$33,803,000**
• Continued development and demonstration of experimental and/or modeling and simulation platforms and processes to assess component response to combined neutron and blast environments, component response to threat-relevant neutron environments, and component and integrated component response to threat-relevant x-ray and gamma environments. • Supported research, development, and engineering for x-ray radiation environment testing (Saturn) recapitalization. This is a key area where we have an extremely aged and limited capability impacting our ability to ensure U.S. systems will be able to survive adversarial capabilities whose performance has increased over the years. • Continued development of joint cold x-ray surrogate test capabilities. • Supported research, development, testing, and engineering to develop capabilities to assess combined and hostile/normal environments for current and future stockpile systems.	• Continue development and expansion of diagnostics for environment characterization and response data. • Complete the SCDS FY 2023 Hostile Mitigation pegpost. • Continue support of conceptual design activities for the CREST facility. • Establish broader use of uncertainty quantification across hostile engagement applications. • Continue experimental source development for enhanced hostile environments. • Improve ability to field flexible test and experiment platforms for combined environments testing for device level physics research. • Further high explosive blast analysis capability development, experiment design, diagnostic development.	• The increase is based on planned conceptual design activities and execution of additional requirements for CD-1 consideration for the CREST facility.

Engineering and Integrated Assessments
Studies and Assessments

Description

The Studies and Assessments Program, established by Congress in FY 2020, improves oversight and visibility of pre-Phase X / 6.X assessments. Beginning in FY 2023, this program improves the ability of the Office of Defense Programs to rapidly respond to Nuclear Weapons Council (NWC) requests for joint studies of potential weapon and nuclear security enterprise (NSE) capabilities to support future USSTRATCOM needs. These studies result in preliminary technical, cost, and program feasibility assessments to inform NWC decisions about the future nuclear weapon stockpile and supporting enterprise. The Studies and Assessments program collaborates with other Engineering and Integrated Assessments and Weapon Technology and Manufacturing Maturation programs to align their scope with these future capability needs as well as with other NNSA programs to coordinate impacts from these studies. Additionally, will continue to advance our scientific capabilities to meet evolving threats and future stockpile demands and develop innovative business practices to improve NSE collaboration and agility.

Highlights of the FY 2023 Budget

- Explore NNSA weapon design options and potential stockpile-to-target sequence (STS) environments in support of the U.S. Air Force Next Generation Reentry Vehicles study, which examines future aeroshell concepts for the LGM-35A Sentinel, also known as the Ground-Based Strategic Deterrent.

FY 2024 – FY 2027 Key Milestones

- Conduct early weapon design option studies and STS environment analyses to identify research and development activities for the Future Strategic Land-Based Weapon, the Future Strategic Sea-Based Weapon, and/or the Future Air-Delivered Weapon, per NWC strategic direction.
- In coordination with USSTRATCOM and the Military Services, conduct program technical, cost, and feasibility assessments to inform NWC decision-makers of the strategic impacts from the pursuit of various nuclear security enterprise and weapon capabilities.

FY 2021 Accomplishments

- Completed complexity analysis of the SLCM-N AoA.
- Transitioned the Navy Feasibility Study into and initiated design studies for the W93 / Mk 7 Phase 1, Concept Assessment, per NWC direction.

Studies and Assessments
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Studies and Assessments $0	**Studies and Assessments $5,000,000**	**Studies and Assessments +$5,000,000**
• There were no pre-Phase 1/6.1 requirements identified in the FY 2021 Enacted budget.	• Conduct multi-discipline studies to understand and assess future weapon concepts for the nuclear stockpile, to include engaging with the DoD to gather insight into their needs. • Determine the feasibility of inserting technology and/or manufacturing processes into the stockpile and perform benefit and risk analyses. • Develop and deploy innovative business practices, communication tools, and collaboration models to improve NSE agility.	• This increase funds Studies and Assessments to support pre-Phase X/6.X studies and feasibility assessments of future nuclear weapon stockpile requirements, to include funding for joint studies with the DoD.

Engineering and Integrated Assessments
Aging and Lifetimes

Description

Aging and Lifetimes is responsible for detecting and predicting the onset of harmful aging phenomena in nuclear weapon materials, components, and subsystems before they can degrade the nuclear deterrent. Nuclear weapons contain many materials and components that age in unique and complex ways. Aging and Lifetimes studies these aging phenomena to identify potential aging issues, and, if necessary, provide solutions to fix them before degradation can impact the deterrent. Aging and Lifetimes also ensures new materials introduced into the stockpile, whether through life extension programs, modifications, or alterations, will not cause aging problems in the future. These activities require a deep understanding of the material, chemical, metallurgical, physical, and engineering behaviors that control the performance, aging, and degradation of various components in the weapon systems.

To achieve its programmatic goals, Aging and Lifetimes conducts three types of key activities:

- Aging Studies, which support decisions on when and whether to reuse or replace weapons components and materials.
- Computational Modeling, which predicts the impacts of aging on weapon components and materials.
- Diagnostic Tool Development, which develops and provides diagnostic tools for improving the quantity and quality of surveillance of the enduring and future stockpiles.

Aging and Lifetimes activities include:

Non-Nuclear Components – This activity addresses aging related phenomena of non-nuclear components and identifies the highest-risk aging concerns that cross-cut multiple weapon systems. These components perform a wide variety of essential functions and ensure that the nuclear weapon always performs as intended.

High Explosives (HE) in the Nuclear Explosives Package – This activity determines when age-related changes in main charges and boosters may affect weapon safety, performance, and reliability. This is accomplished through a combination of predictive modeling, experimental techniques, non-destructive evaluation tools, and assessment of surveillance data.

Plutonium for Pits – This activity develops and delivers new analytical methods, tools, modeling, and diagnostics, including non-destructive evaluation techniques, to achieve timely, less invasive, and more cost-effective component surveillance.

Canned Subassemblies (CSAs) and Cases – This activity provides experimentally validated material aging models and integrated materials chemistry simulations needed to determine when, or if, CSAs or cases will need to be refurbished or replaced.

Non-Nuclear Materials – This activity assesses aging of polymeric materials (i.e., potting materials, cushions, pads, adhesives, structural supports, containment vessels for explosives, and detonator cable assemblies). Activities include developing diagnostics for testing non-nuclear materials, assessing new methods and materials, quantifying outgassing and compatibility of polymers with other stockpile materials, and developing predictive lifetime models for polymeric materials and components.

Systems – This activity augments the existing surveillance program with system-level evaluation diagnostics that include new capabilities to measure component-level parameters during system testing and provide improved confidence in future weapons reliability, safety, and performance.

Highlights of the FY 2023 Budget

- Update and publish annual comprehensive aging and lifetime predictions used to assess the lifetime of key weapon components.
- Provide timely warning of aging phenomena that threaten the effectiveness of various nuclear weapon systems.
- Provide diagnostic tools for improving effective and efficient stockpile evaluation for the enduring stockpile.
- Provide capabilities to assure stockpile modernization efforts do not introduce unacceptable aging risk.

- Support and evaluate accelerated aging tests (designed to determine the response of individual materials to anticipated environmental stressors.
- Provide capabilities for accelerated aging and compatibility tests on relevant combinations and permutations of new and re-used materials.
- Support ongoing CSA aging studies, non-nuclear materials and components studies, and high explosives studies.
- Develop and validate models used to non-destructively assess aging of the stockpile (CSA corrosion, HE aging, polymer aging, etc.).

FY 2024 – FY 2027 Key Milestones
- Explore modeling concepts to advance weapon surveillance.
- Investigate feasibility of new technologies utilizing embedded sensors.
- Review and leverage historical legacy surveillance data, using state-of-the-art methods, to detect potential aging signatures that may have been overlooked in previous analyses.
- Complete Aging Studies on MgO Thermal Batteries.
- Complete Gapstick evaluation of the variability in the sensitives of conventional high explosives.
- Complete research into the Kinetic Response of the delta-phase 239Pu-Ga Alloy Lattice to self-irradiation and thermal cycling.
- Procure and install Aging Studies Equipment, specifically the Enhanced Fracture Toughness Tester.
- Update and publish annual stockpile aging and lifetime assessment reports to predict aging issues in essential stockpile components.
- Continue development of other non-destructive diagnostic (including the Active Fast Neutron Inspection, Magnetic Resonance Imaging for polymers, and Rapid Gas Analysis) to TRL 7 for transition and deployment to core surveillance,
- Deliver the SCDS FY 2026 Modern Surveillance Methods pegpost with scope jointly developed across Assessment Science, ASC, and Stockpile Management programs.
- Provide timely warning of aging phenomena that threaten the effectiveness of the nuclear deterrent.

FY 2021 Accomplishments
- Developed a Solid-Lubrication Test Bed to evaluate the aging of solid lubricants that are critical to the performance of safety mechanisms.
- Tested materials aging of epoxy molding compound and die-attach adhesives under mechanical load, to better understand observed aging mechanisms of microelectronics packages.
- Made progress towards understanding unique aging characteristics of additively manufactured (AM) materials, by studying the corrosion susceptibility of AM metals as a function of processing parameters, and surface characteristics.
- Achieved a major step in the development of a non-destructive acoustic mechanism tester by successfully demonstrating the ability to measure stronglink performance using the method on a High Operational Tempo Shot test.
- Used an improved method for detecting moisture levels that could potentially lead to harmful aging mechanisms to pass a feasibility study through use weapon-equivalent gas samples.
- First time calculations of both experimentally consistent hydride formation enthalpy and hydrogen solubility in bulk material were achieved simultaneously with a single, consistent Density Functional Theory (DFT)-based methodology.
- Conducted experiments that verified a key aging requirement for optical initiation; no discernable degradation was observed in the transmission of light due to exposure to intrinsic environments.
- Used testing and data analysis of advanced scintillators to show that new materials and designs result in significant resolution and contrast improvements.
- Completed radiation exposure experiments on PETN, PATO, and PBX9501 explosives, showing no significant changes to the materials after a two-year radiation dose at the SNL Cs-137 source.
- Led technical exchanges to facilitate in technology transfer of an A&L developed Gapstick test from LANL to Pantex.
- Fully implemented Handheld Diffuse Reflectance Infrared Fourier Transform Spectroscopy (HHDRIFT) in Quality Evaluation as a regular surveillance tool negating the need for a dual Diffuse Reflectance Infrared Fourier Transform Spectroscopy (DRIFT) analysis in Development.
- Produced high light yield scintillator plates for neutron imaging application.
- Developed a new capability for direct measurements of mixed-mode bond strength in adhesive bonded HE joints.

- Produced full-system moisture modeling calculations for 80-4 using ReSorT tool.
- Successfully implemented a new accelerator for neutron imaging and produced first deuteron beam on the system.
- Conducted tensile and fracture toughness testing on charged and aged hydrogen isotope specimens.
- Completed destructive examination and reporting on two hydrogen-filled AM aluminum vessels, aged and closed with valves, including characterization of valve components.
- Conducted x-ray diffraction experiments to determine hydrogen loading and confirmed with nuclear magnetic resonance.
- Developed a new process for cleaning up components during W76-0 dismantlement to preserve adjacent components.
- Created and modified a snipping tool for extracting gas to be tested.
- Completed a study of a lightning arrestor connector to identify the cause of failure to trigger and begin work on correcting this default.
- Characterized additively manufactured foams with computational tools.

Aging and Lifetimes
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Aging and Lifetimes $62,260,000	**Aging and Lifetimes $59,682,000**	**Aging and Lifetimes -$2,578,000**
• Developed advanced imaging systems for detecting the precursors of harmful weapon aging. • Provided predictive capabilities for extrapolating the effects of corrosion and other aging phenomena. • Promulgated stockpile aging and lifetime assessment reports. • Deployed full-scale Multi-Mass Leak Detector to Production and Core Surveillance to improve operations at the production plants. • Qualified and deployed new scintillators for CoLOSSIS I and II to improve imaging of aging materials. • Validated acoustic sensor for flight environments to better understand and model component performance. • Updated and published aging and lifetime predictions used to assess the lifetime of key weapon components. • Conducted studies to investigate plutonium aging and determine impacts from corrosion. • Conducted high explosive studies examining main charges and boosters used to detect aging-related changes in behavior. • Supported and evaluated improved methods of accelerated aging, particularly for advanced materials such as AM parts.	• Develop customized Accurate Detonator Advanced Performance Testing (ADAPT) tests and analysis capabilities to investigate holistic detonator performance. • Transition advanced diagnostics, including the Multi Mass Leak Detection tools, the Acoustic Resonance Spectroscopy State-of-Health Analyzer, and the Shell Acceleration Initiation Train (SAIT) to Core Surveillance. • Assess components to inform material and component aging models. • Update and publish aging and lifetime predictions used to assess weapon component lifetimes. • Develop validated understanding of energetic material degradation resulting in corrosion of critical elements in components. • Develop validated understanding to inform predictive models of cracking that lead to loss of hermeticity. • Develop structural response model that enables predictions of degradation caused by embrittlement. • Quantify mechanical degradation in epoxies, encapsulants, and foams in stockpile environments and their effects on surrounding components. • Develop validated capability to inform lifetime estimates of detonators, isolators, and other energetic components.	• The decrease reflects a shift of resources to support higher priority NNSA efforts.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
• Investigated aging phenomena to ensure an early warning of any significant impact to the effectiveness of the nuclear deterrent.	• Complete aging models for high-risk components.	

Engineering and Integrated Assessments
Stockpile Responsiveness

Description
Per Section 3112 of the 2016 NDAA, the Stockpile Responsiveness program (SRP) underpins a "nuclear posture that is agile, flexible, and responsive to change" with the purpose of "ensure[ing] the nuclear deterrent of the United States remains safe, secure, reliable, credible, and responsive". The Nuclear Weapons Council has provided SRP program guidance to support stockpile modernization through development of methods to reduce the time and cost to produce nuclear weapons as the overarching priority, while also examining options to address a set of future challenges to the nuclear deterrent. Paralleling this, the House Armed Services Committee Report 116–442 for FY 2021 requested that the SRP direct efforts to the challenge of "production responsiveness" to meet accelerated production requirements for modernization, as contrasted with the program to maintain the present stockpile.

Consequently, NNSA executes the SRP as a science, engineering, and technology program to exercise and enhance capabilities to proceed rapidly from clean sheet designs through prototyping, testing, and development for production and qualification, including the rapid execution of hydrotests, flight tests, and environmental tests. The program especially pursues new production and qualification techniques to dramatically accelerate the rate at which qualified components can be produced, while reducing costs and complexity. SRP emphasizes technology that improves system performance, including safety, surety, feasibility, cost, and time to produce and qualify the system.

In the conduct of its activities, SRP is guided by its statutory objectives to exercise and enhance capabilities required to support all phases of the joint nuclear weapons lifecycle process; to transfer knowledge and skills to the newer generation of nuclear weapon designers and engineers; and to strengthen integration between DoD and NNSA A significant emphasis of the SRP is on laboratory-production plant collaborations focused on augmenting production responsiveness. The three laboratories (LANL, LLNL, and SNL) are designated as design agencies (DAs), while the production plants (CNS Pantex and Y-12, KCNSC, and SRS) are designated as production agencies (PAs). LANL and SNL have the unique distinction of holding a PA and DA designation because of their production mission responsibility for select components.

SRP activities are undertaken with the view that modernization and other potential responses to future challenges will require developing new systems or subsystems employing new technologies and materials. This necessarily invokes increased technical risk beyond the limited risk presently accepted in LEP planning. To enhance capabilities to address this risk, SRP program activities described below are chosen in part to demonstrate the ability to accelerate the design, prototype, test cycle to decrease the time and cost to develop a producible and qualifiable design.

Stockpile Responsiveness activities include:
Acceleration of the Nuclear Weapons Lifecycle and Reduction of Costs – The highest-identified priority by the NWC and Congress is for SRP is to examine alternative approaches to design, manufacturing, certification, and qualification to accelerate the timeline for the nuclear weapons lifecycle and reduce costs. Because the SRP lies expressly outside the acquisition process, the SRP can take risks without impacting planned LEPs or detracting from confidence in the present stockpile. It can demonstrate the potential for alternative processes and materials to deliver nuclear weapons components and systems rapidly.

Analysis of Emerging Threats and Technology Challenges and Opportunities – A small, but important effort to use laboratory technical expertise to analyze the consequences of emerging threats, to project technology trends, and to understand the implications for our deterrent on time scales consistent with the lifecycle of stockpile systems, which can greatly exceed the time horizon of Intelligence Community analyses. This effort supports ad hoc technical teams assembled to conduct rapid analyses of issues and scenarios and supports analyses executed on behalf of the Combatant Commands, principally U.S. Strategic Command.

Challenge Problems – Significant one-year to multi-year multi-site efforts to exercise integrated nuclear weapons design capabilities against potential future threats. These look at problems beyond the time frame of nuclear weapons acquisition activities to explore design for manufacturability and the certification and qualification challenges presented in such designs. These problems set a systems context for exploring manufacturing, prototyping, and testing issues. To date, NNSA, with the concurrence of the DoD, has focused on two challenges: strategic deep underground target defeat and defended target defeat. They further reinvigorate the ability to design and develop integrated systems using new technologies and capabilities and provide the next-generation experience in the trade-offs needed for design optimization.

Prototyping, Testing, and Flight Testing – Providing the next generation of designers and engineers hands-on experience in system development, achieved through exercising and accelerating the design, build, test cycle to overcome the technical risk in new technology development. This includes building and testing of non-nuclear prototypes of engineered systems and components, including accelerated hydrotest, environmental testing and flight tests of non-nuclear prototypes. The program is exploring the use of the launch services to provide low-cost, high tempo flight testing to accelerate the development of systems dependent upon new technologies, configurations, and materials. A key goal of this activity is providing junior staff experience in the process of turning ideas into a working system.

Highlights of the FY 2023 Budget

- Continue to foster design agency/production agency (DA/PA) collaboration efforts to develop responsive manufacturing and qualification processes.
    - Continue maturing advanced manufacturing technologies along with on-machine metrology and inspection methodologies to accelerate production and qualification.
    - Continue deploying digital collaboration and digital engineering tools complex-wide.
    - Exercise design for manufacturability in a collaboration between design and production agencies on a prototype system inserting new manufacturing technologies in the production complex that can shorten the production timelines and costs of capabilities needed for modernization. Examine concepts such as spiral development to improve responsiveness of the design and manufacturing lifecycle.
    - Demonstrate performance and insensitivity of new energetics to allow qualification as IHE.
    - Prototype and document processes for system acceleration, including model-based engineering, model-based system engineering, and design-agency/production-agency hardware prototyping and manufacturing acceleration.
- Mature technologies identified in the design competition outlined in the FY 2018 NDAA for a potential future strategic missile warhead, exploring different manufacturing approaches and stockpile-to-target sequence environments compared to today's systems.
    - Complete assembly of defended-target delivery vehicle prototype with integrated non-nuclear warhead componentry and collect system ground-qualification test data to support a future flight test.
- Complete execution and analysis of experiments to support strategic deep underground target defeat, including Davis-Gun and hypersonic sled-track tests.
    - Use the hypersonic sled-track test in collaboration with Delivery Environments to demonstrate an accelerated testing methodology developed in collaboration with Department of Defense facilities. This capability development lowers the cost, schedule, and technology risks for future tests are planned for the stockpile modernization program.
- Deliver the SCDS FY 2023 Rapid Prototype Cycle pegpost to build a non-war-reserve prototype and develop tools to improve cross-site collaboration in areas like digital engineering.
- Continue to demonstrate commercial flight test capabilities to provide high tempo, high fidelity flight testing for system development.

FY 2024 – FY 2027 Key Milestones

- Use DA/PA collaboration to demonstrate the ability to progress from a clean sheet design through demonstration prototype in two years to include hydrotesting, flight testing, and environmental testing using digital engineering.
- Explore new manufacturing techniques and process improvements leading to a more agile and responsiveness production facility.
    - Deploy digital twin technology for manufacturing machines to shorten production process development.
    - Implement demonstrated machine learning technologies to optimize and accelerate design phase.
    - Continue deployment of responsive production technologies and develop associated designs optimized for manufacturing.

- Develop and demonstrate a framework for weapon development that reduces to the minimum high-cost integrated system testing for certification by leveraging modeling capabilities.
- Prove out the design methodology, manufacturing strategy, processes, and cost requirements to implement a spiral development approach.

- Work in partnership with DoD stakeholders to develop and demonstrate system analysis capabilities that can enhance our nuclear deterrent.
- Use the prototype spiral development approach to demonstrate the ability and explore challenges to achieve cost effectiveness in design and production with respect to the program of record.
- Continue to demonstrate an accelerated design/build/test cycle to increase the speed of learning in developing, adapting, and integrating new technologies.
- Continue to explore methods to reduce time, cost, and footprints for product qualification.
- Deliver the FY 2026 SCDS Future Deterrent pegpost that will exercise joint design and production agency personnel in pursuit of shorter warhead development timelines.

FY 2021 Accomplishments

- In support of production responsiveness, SRP fully integrated the production plants into the SRP program to explore issues from design for manufacturability to specific production processes and improved methods for qualification.
  - Completed the installation and commissioned an Electron Beam Cold Hearth Melting system for production of binary material.
  - Explored potential new materials and manufacturing capabilities that could shorten the delivery of long lead time components for stockpile systems.
  - Designed, fabricated, and tested the first iteration of prototype hardware that could be leveraged for multiple applications.
  - Deployed complex-wide digital collaboration tools to accelerate data exchange and speedup collaboration between design and production agencies.
- Established a program to demonstrate commercial launch services to provide low-cost, high tempo flight testing required to integrate modern technologies, configurations and materials into systems required under stockpile modernization. The first launch was from Spaceport, NM, to White Sands Missile Range and integrated a LANL test RV with an Up Aerospace missile with the successful collection of inflight data through a LANL Cubesat.
- Completed the NWC task on Hard and Deeply Buried Targets (HDBT) defeat by examining a wide range of design options that could be mated to potential DoD delivery systems.
- Contributed to the development of the next generation of leaders by using young and mid-career technical staff to lead design teams and technology development teams. Training early and mid-career individuals, the program exercised processes to manage work with DoD organizations to explore alternatives to address future challenges to the deterrent.
- Executed Davis gun tests at the Energetic Materials Research and Testing Center (EMRTC, Socorro, NM) to reestablish a vital capability for severe mechanical environments, validate simulations of penetrator mechanics, demonstrate novel shock mitigation technologies, and analyze novel concepts for mechanical hardening of components.
- Performed hypersonic reverse ballistics testing at the Arnold Engineering Development Complex (AEDC) at Arnold AFB, along with several other small-scale tests, in preparation for an upcoming full-scale hypersonic sled track test.
- Reinvigorated DOE reentry vehicle prototyping capability enabling earlier execution of integrated component certification activities and system-level safety tests.

Stockpile Responsiveness
Activities and Explanation of Changes

<table>
<tr><th>FY 2021 Enacted</th><th>FY 2023 Request</th><th>Explanation of Changes
FY 2023 Request vs
FY 2021 Enacted ($)</th></tr>
<tr><td>Stockpile Responsiveness $70,000,000</td><td>Stockpile Responsiveness $68,742,000</td><td>Stockpile Responsiveness -$1,258,000</td></tr>
<tr><td>• Incorporated the production plants in a range of activities joint with the nuclear weapons laboratories to accelerate production, qualification, and acceptance testing.
• Performed analysis of emerging threats and technological challenges.
• Continued design competition activities.
• Continued to explore new materials and production techniques.
• Completed experimental activities for delivery environment for HDBT defeat.
• Explored and developed high potential opportunities to accelerate production of future systems and components.
• Incorporated design for manufacturability exercises into challenge problem execution.
• Explored opportunities for flight testing prototype hardware of non-nuclear systems and components.</td><td>• Provide the younger generation of designers and engineers with experience in developing rapid solutions to stockpile system issues by developing and employing modern technologies and methods and performing tests to prove out the solutions.
• Continue DA/PA efforts to develop advanced manufacturing and production technologies that can accelerate the delivery of long lead time materials and components needed for testing and system development.
• Develop high tempo hydrotesting, flight testing, and environmental testing capabilities.
• Support analyzing and developing approaches to addressing high priority future threat scenarios in consultation with the Department of Defense.
• Deliver the SCDS FY 2023 Rapid Prototype Cycle pegpost that will build a non-war-reserve prototype and develop tools to improve cross-site collaboration in areas like digital engineering.
• Develop alternative approaches to qualification and acceptance testing that can reduce costs and time frames as well as laboratory and production facility resources.</td><td>• The decrease reflects a shift of resources to support higher priority NNSA efforts.</td></tr>
</table>

Engineering and Integrated Assessments
Advanced Certification and Qualification

Description
Advanced Certification and Qualification (ACQ) develops tools and methods to ensure there is a certification path for stockpile systems and components in the absence of additional nuclear explosive testing by integrating computing, science, technology, and engineering advancements to facilitate certification of future life extension programs (LEPs) and other warhead needs. Additionally, ACQ in collaboration with Advanced Manufacturing Development and the Stockpile Responsiveness program (SRP) explores methods to accelerate the qualification of components and manufacturing processes and reduce costs and laboratory and plant facility requirements. In support of modernization initiatives, ACQ has moved from understanding the certification basis for the legacy stockpile to developing certification methodologies for the stockpile as it is evolving, including planned LEPs and potential systems that could be needed in the future. ACQ is exploring the qualification benefits and challenges of modular architectures proposed for LEPs and future stockpile systems.

More specifically, Advanced Certification and Qualification: (1) develops certification methodologies and integrates new experimental data into common models and assesses any impacts on stockpile performance, (2) develops certification and qualification paths for advanced manufacturing and replacement materials, (3) conducts certification readiness exercises in partnership with other programs to explore certification and qualification challenges in technologies that are being developed or demonstrated for future LEPs, and (4) explores the certification challenges of advanced surety technologies.

Building on the success of design agency/production agency (DA/PA) collaborations demonstrated in SRP, late in FY 2021, ACQ provided funding for Kansas City Nuclear Security Campus (KCNSC), Y-12, and Pantex. This funding was intended to support DA/PA collaborations to further develop qualification methodologies to support advanced manufacturing methods and to seek ways to reduce the time, cost, and footprint required for qualification of stockpile components and material.

Highlights of the FY 2023 Budget
- Develop certification approaches for systems and components responsive to stockpile modernization initiatives.
- Develop capabilities to enable assessment and qualification of designs that enable agility to meet emerging threats.
- Develop approaches to accelerating and streamlining qualification approaches for new manufacturing methods, materials, and components to reduce time and costs to introduce into the stockpile and to address and manage the inherent technical risk in new approaches.
- Continue a certification readiness exercise to assess the qualification readiness of proposed modular architectures to improve the flexibility and maintainability of stockpile systems and reduce lifecycle costs.
- Execute hydrodynamic tests to support improved technologies and raise TRLs and MRLs.
- Continue to assess the archive of nuclear tests, study of failure modes, and other advanced methods to facilitate use in certification of upcoming sustainment programs.
- Develop understanding of scaling and surrogacy to support the experimental basis for weapon assessments.
- Conduct experiments supporting product-based certification methods of components made with advanced manufacturing.
- Exercise the certifiability of reuse, surety, and hardening concepts, as well as concepts incorporating new manufacturing technologies.
- Develop Advanced Materials qualification methodology to enable component material replacement options.
- Advance microstructure aware simulation capability and deploy in SNL production codes for designers.
- Continue to assess new options and materials and manufacturing techniques for thermal protection systems and develop qualification methodologies.
- Continue to develop and mature the common qualified testers improving flexibility to support future products, reducing long development, build, and qualification cycles.
- Develop new inspection techniques to validate and certify new complex geometries because of advanced manufacturing techniques.
- Continue building on the NNSA 2025 Vision for an Assured Nuclear Enterprise.

FY 2024 – FY 2027 Key Milestones

- Continue to develop an understanding of the impacts of stockpile modernization requirements on certification and qualification methodologies and develop responses to those impacts.
- Perform hydrotests to understand the scaling of performance with dimensions in IHE systems.
- Perform hydrotests to certify PBX9701 and X-0298 high explosive performance.
- Advance the machine learning toolkit for certification and qualification.
- Develop a certification strategy for non-standard secondaries.
- Perform flight test qualification of NNSA and Air Force Research Laboratory concepts using Red-X commercial platform.
- Establish certification strategies for non-standard primaries, including hydros.
- Define performance-based requirements for major materials and components produced at the plants to improve manufacturability.
- Develop and implement testing and qualification methodologies that are common to the design agencies at the production plants wherever achievable to reduce redundancy and optimize resources.
- Define the design space envelope with high confidence for certification to speed up design timelines, and lower development risks.
- Support qualification efforts for advanced materials.
- Down select and define qualification methodologies for new thermal protection system materials.
- Support qualification of additively manufactured brackets and supporting structures and qualification methodologies for these materials in non-destructive applications.
- At production plants, develop common testers for qualification and mature model-based product acceptance methods.
- Develop methods to qualify builds of complex geometric structures.

FY 2021 Accomplishments

- Supported a JASON letter study of the impact of stockpile modernization requirements on the principal certification methodology QMU (quantification of margins and uncertainties).
- Developed in-situ inspection technologies to accelerate production rates and yields and reduce qualification testing for several new manufacturing technologies, including additive manufacturing of metals and high explosives.
- Completed thermomechanical shock experiments on advanced materials.
- Developed experimentally validated meso-scale simulation capability for AM materials and components.
- Built capability for development and testing of advanced thermal protection system materials.
- Completed a hydro test in support of the Joint Technology Demonstrator (JTD).
- Developed methods for additively manufactured, structured, high explosives including development of an additively manufactured plane-wave generator.
- Completed development of diagnostics techniques to improve data collection from subcritical experiments.
- Completed gas-gun experiments in support of advanced surety solutions.
- Successfully executed a “blind test” of methodologies to define key performance characteristics from subcritical experiments.
- Performed key experiments for certification of optically initiated detonators.
- Designed an experiment for resolution of a neutron reactivity anomaly.
- Determined that PBX9501 does not undergo DDT (deflagration to detonation transition) for Weapons Response Initiative (WRI) applications. Included in Pantex safety basis via CASTLE.
- Performed direct light PBX9701 “furball” experiments using commercial chip-slapper detonators.
- Performed MEDUSA series of PBX9701 experiments on pRad, including an arc geometry experiment.
- Designed (with LLNL) a brand-new Nuclear Explosive Package or use in the Agile Processes and Technology (APT) demonstrator.
- Sponsored (with DE) integration exercises with AFRL.
- Executed hydro test in support of ECSE technology development.
- Matured the ability to perform acceptance testing using model-based product definition.
- Strengthened and improved nuclear enterprise assurance inspection techniques.
- Installed inline inspection equipment to monitor in-process build quality.

Advanced Certification and Qualification
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Advanced Certification and Qualification $60,649,000	**Advanced Certification and Qualification $58,104,000**	**Advanced Certification and Qualification -$2,545,000**
• Developed certification approaches for systems and components responsive to emerging threats. • Executed hydrodynamic tests to support technology development as well as investigate ways to significantly reduce the cost of hydrodynamic tests. • Assessed nuclear tests, studies of failure modes, and other advanced methods to facilitate use in certification of upcoming sustainment programs. • Studied supporting understanding of scaling and surrogacy to support the experimental basis for weapon assessments. • Experimented supporting product-based certification methods of components made with advanced manufacturing. • Exercised on the certifiability of reuse, surety, and hardening concepts, as well as concepts incorporating new manufacturing technologies. • Continued an exercise to assess the qualification readiness of proposed modular architectures to improve the flexibility and maintainability of stockpile systems and reduce lifecycle costs. • Included Pantex, Y12, and Kansas City in ACQ to develop improved methods for qualification and acceptance testing.	• Continue addressing impacts of stockpile modernization on certification and qualification methodologies. • Continue DA/PA collaborations to accelerate qualification processes and methods for new materials and manufacturing processes. • Continue hydrotesting in support of the development of certification and qualification methods. • Continue a certification readiness exercise to assess the qualification readiness of proposed modular architectures to improve the flexibility and maintainability of stockpile systems and reduce lifecycle costs. • Develop understanding of scaling and surrogacy to support the experimental basis for weapon assessments. • Conduct experiments supporting product-based certification methods of components made with advanced manufacturing. • Develop Advanced Materials qualification methodology to enable component material replacement options. • Continue to assess new options and materials and manufacturing techniques for thermal protection systems and develop qualification methodologies. • Continue to develop and mature the common qualified testers.	• The decrease reflects a shift of resources to support higher priority NNSA efforts.

Overview

The Inertial Confinement Fusion (ICF) program provides high energy density (HED) science capabilities and expertise that support research and testing across the breadth of the Stockpile Stewardship Program. Its two-fold mission is to meet immediate and emerging HED science needs to support the deterrent of today, and to advance the R&D capabilities necessary to meet those needs for the deterrent of the future. The ICF program enables access to and study of the HED regime through (1) the design and execution of complex physics experiments to improve our fundamental science understanding, (2) the development of instrumentation to diagnose physics phenomena at the extreme temperature, pressure, and density conditions relevant to nuclear weapons performance, and (3) the development and operation of experimental facilities capable of reaching those conditions. The ICF program's flagship facilities, the NIF at LLNL, Z at SNL, and Omega at the University of Rochester's Laboratory for Laser Energetics (LLE), represent a complementary set of capabilities designed to meet the diverse needs of weapons physics, the pursuit of ignition, and the exploration of fundamental HED science.

Since most of the energy in a nuclear weapon is generated by matter in HED conditions, understanding the behavior of matter and energy in the HED regime is critical to understanding and predicting the performance of both nuclear weapon primaries and secondaries, as well as the response of weapon components to extreme hostile radiation environments. The ICF program leverages its experimental design expertise and computational modeling capabilities, diagnostic technology, target engineering and fabrication infrastructure, and national HED facilities to ensure high fidelity experimental capabilities and data are available to support a range of NNSA missions. Its capabilities are used by partner programs to assess and certify the existing stockpile, inform design decisions for current life extension programs, investigate hostile nuclear environments, and support research by DoD and key international partners. The program represents the only experimental option available to address many of the weapons-relevant HED science challenges without resuming underground explosive nuclear testing.

The ICF program supports NNSA's long-term R&D mission by developing the knowledge and capabilities necessary to reach controlled thermonuclear fusion in the laboratory. Reaching a burning plasma platform and eventually producing high fusion yield will open the door to a range of important weapons physics that have been unreachable since the cessation of underground explosive nuclear testing. This is among NNSA's most high risk, high reward research efforts. Not only does it attract and challenge some of the nation's best physicists and engineers to the complex, but it also represents an important component of NNSA's preparation to meet the stockpile science challenges of the 2030s and beyond.

In FY 2020, NNSA and the JASON Defense Advisory Group completed two important reviews of the ICF program. The JASON review found that the program remains valuable to the stewardship mission and recommended several shifts in program strategy to optimize scientific progress over the next decade. The internal ICF 2020 review assessed the program's proximity and scaling to ignition and concluded that the ignition threshold is likely beyond current experimental capabilities. Results of NIF experiments in FY 2021 exceeded the study's prediction with near-ignition results of 1.3 MJ fusion yield, opening the door to the study of a burning plasma regime and development of platforms for yield applications relevant to nuclear weapon outputs, environments, and effects. The priority recommendations of the ICF 2020 study largely remain valid and urge for a research program focused on:

- resolving key gaps in physics understanding,
- acquiring information at the current scales to justify cost, scope, and schedule for any future experimental capability investments, and
- pursuing world-leading research that attracts early-career scientists and engineers to all three national HED facilities.

A primary area of focus in FY 2023 will continue to be the implementation of the highest-priority recommendations from those FY 2020 reviews. Activities will be focused on:

- Maintaining the technical leadership and capabilities necessary to recruit, train, challenge, and retain the highest caliber of scientists and engineers to engage in stockpile stewardship.

- Exploring innovative and disruptive target designs, diagnostics, drivers, and other specialized technologies, simulation capabilities, and analytical tools to maintain leadership, challenge program scientists, and advance physics understanding to support the priorities of stockpile stewardship.
- Addressing key gaps and uncertainties in fundamental physics understanding of fusion target performance.
- Promoting cross-laboratory collaboration and external engagement to improve program efficiencies and ensure continued global leadership.
- Achieving a dependable, repeatable output and development of yield applications relevant to nuclear weapon outputs, environments, and effects.

The FY 2023 Budget supports continued research and operations at NNSA's preeminent HED facilities, with research efforts focused on 1) maturing HED stockpile science concepts and platforms in support of the broader NNSA portfolio and 2) advancing ignition and burning plasma science in keeping with the findings of internal and external FY 2020 reviews. Emphasis on improving operational efficiencies at the NIF, Z, and Omega and on extending the lifetime of these facilities, will continue.

The ICF program is made up of three subprograms:

1. **HED and Ignition Science for Stockpile Applications** develops and matures the tools to enable partner programs to investigate weapons physics phenomena for near-term applications and pursues controlled thermonuclear fusion to meet next-generation stockpile science needs.
2. **ICF Diagnostics and Instrumentation** establishes new diagnostic capabilities and experimental support systems through the research and development of specialized technologies necessary to execute experiments studying matter under extreme HED conditions.
3. **Facility Operations** provides the support and services required to ensure the safe and efficient operations of the national HED facilities, including operations, maintenance, load and target consumables, and the research and engineering to sustain facility capabilities.

Inertial Confinement Fusion
HED and Ignition Science for Stockpile Applications

Description

This subprogram supports R&D in high energy density (HED) physics, including the study of thermonuclear fusion. In the HED state, materials experience pressures greater than one million earth atmospheres and reach temperatures and densities far exceeding those of normal or condensed matter, generating complicated behaviors predominantly described by plasma physics. This complex and dynamic state dominates energy generation in nuclear weapons, making its study a key component of the Stockpile Stewardship Program (SSP). The research supported in this subprogram develops and matures the tools that enable partner programs to investigate dynamic material properties, fluid and plasma hydrodynamics, hydrodynamic instability-induced mix, burn, boost, radiation transport and opacities, and yield applications relevant to nuclear weapon outputs, environments, and effects. This collection of capabilities, in combination with the national HED facilities and enabling diagnostics, provides NNSA's only access to many of these phenomena outside of underground nuclear testing.

This subprogram coordinates closely with the Assessment Science and nuclear modernization programs to conceive, mature, and provide platforms to execute experiments at all the national HED facilities to meet the near-term requirements of stockpile stewardship. These tools provide access to materials data at extreme conditions, allow the study of hostile radiation environments, and make it possible for NNSA, Department of Defense users, and key international partners to probe a variety of complex weapons physics phenomena in the absence of underground nuclear testing.

This subprogram's long-term focus is on R&D to achieve ignition, a burning plasma platform, and ultimately high fusion yield in the laboratory. When realized, these will provide a set of capabilities critical to the long-term viability of the SSP — particularly, the future qualification of nuclear components, the assessment and certification of the next generation of nuclear weapons in the full range of relevant HED regimes, and the investigation of a range of complex physics that has been out of experimental reach since the cessation of underground nuclear testing. HED and Ignition Science for Stockpile Applications pursues these capabilities through theory, experiments, modeling, design, and engineering. As part of this long-term effort, this subprogram includes three distinct approaches to ignition: laser indirect drive, laser direct drive, and magnetic direct drive. These approaches provide complementary physics insights and diversified technical risks, making use of the unique capabilities of each HED facility in the ICF portfolio.

In support of these short- and long-term efforts, this subprogram develops focused modeling capabilities and analytical methods to improve its predictive capability and maximize its use of experimental data across all mission areas. It also continues to explore and improve its ability to couple driver energy to targets in all experimental configurations to maximize the fidelity of weapons physics experiments and continue to improve the performance of integrated fusion experiments.

In FY 2020, HED and Ignition Science for Stockpile Applications was particularly focused on supporting both the internal assessment of its proximity to ignition and the external review by the JASON Defense Advisory Group to identify its long-term value to the broader stewardship mission. Results of NIF experiments in FY 2021, however, exceeded the study's prediction with near-ignition results of 1.3 MJ fusion yield, opening the door to the study of a burning plasma regime and development of platforms for yield applications relevant to nuclear weapon outputs, environments, and effects. The priority recommendations of the ICF 2020 study remain valid, as they urge a research program focused on resolving key gaps in physics understanding and acquiring information at the current scales to justify cost, scope, and schedule for any future investments in experimental capability and pursuing world-leading research that attracts early-career scientists and engineers to all three national HED facilities. In FY 2023, this subprogram will continue to implement some high priority findings and recommendations from both studies to optimize its contributions to SSP and its progress toward ignition and dependable repeatable platforms for yield applications.

Highlights of the FY 2023 Budget

- Maturing experimental platforms to execute highest-priority HED experiments critical to supporting stockpile needs, including the generation of intense sources of x-rays and neutrons for survivability studies and the development of

high-fidelity approaches to experimentally characterize materials at high pressure.
  - Fusion Yield Platforms (FYP): Fundamental understanding and advancement of fusion performance; enable future access to nuclear weapon-relevant regimes.
  - Assessment Science Platforms (ASP): Leverage FYP innovation for modernization, assessment science, and survivability.
  - Platforms for material properties, radiation sources, hydro, nuclear physics.
  - Simulation and analysis methods (SAM): Improve predictive capability and maximize return on experimental investment across HED science.
  - Integrated ICF design, AI, data analysis, focused models.
  - Driver physics (DP): Provide future stewards access to and control of a wider range of NW-relevant experimental regimes.
- Implement only highest-priority findings and recommendations from the ICF 2020 and JASON reviews in support of stockpile stewardship, which may include some portion of the following goals:
  - Renewing emphasis on the fundamental physics of ignition.
  - Balancing inclusion of innovative and disruptive research across the program.
  - Demonstrating improved compression in laser-driven targets.
  - Advancing ability to understand and predict driver-target coupling through focused physics experiments and improved modeling.
  - Developing understanding and planning for a future high yield capability.

FY 2024 – FY 2027 Key Milestones
- Demonstrable progress toward ignition/high yield to provide access to nuclear weapon energy densities for focused and complex physics.
  - 5-year plan: coupling, compression, uncertainty, proximity (FY 2021-25).
  - HED 5-year plans: energy coupling, scaling uncertainties (FY 2023); establish high-yield facility requirement (FY 2024).
- Platforms for radiation sources and time-resolved materials properties (FY 2023).
- Double-shell burning plasma platform assessment (FY 2025).
- Next-generation ICF code with new architectures (FY 2027).
- Experimentally test combined threats (FY 2027).

FY 2021 Accomplishments
- Achieved record neutron yield from deuterium-tritium targets on NIF, demonstrating increased capsule absorbed energy and symmetry control. Ongoing work will build on this new design class to further improve efficiency and performance.
- Created an improved deuterium/deuterium-tritium first-principles equation-of-state (iFPEOS) table using the latest developments in first-principles methodology. It gives better EOS description for D2/DT in good agreement with shock Hugoniot and sound-speed experiments at pressures less than 200 Gigapascals.
- Used new NIF neutron imaging diagnostic to produce first down-scattered neutron image reconstruction on NIF, demonstrating a capability that will be important to address key remaining challenges in compression fusion targets.
- Studied stagnation and implosion performance indicators at Omega, which drove improvement of radiation modeling and better reproduction of experimental density profiles, key to both Laser Direct Drive (LDD) and Laser Indirect Drive (LID).
- Employed new experimental platforms at Omega to experimentally confirm longstanding theory of laser-plasma instabilities; these insights will make it possible to improve energy coupling and control of future ICF implosions.

HED and Ignition Science for Stockpile Applications
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
HED and Ignition Science for Stockpile Applications $114,792,000	**HED and Ignition Science for Stockpile Applications $104,719,000**	**HED and Ignition Science for Stockpile Applications -$10,073,000**
• Began implementing the findings and recommendations of internal 2020 and JASON reviews focused on the credible and effective pursuit of an ignition platform in support of stockpile stewardship. • Provided HED capabilities and platforms to reduce uncertainty in calculations of nuclear weapons performance in support of annual assessments, life extension programs (LEPs), and future modernization needs (e.g., W87-1), in keeping with the priorities of the Five-Year Plan for HED Experiments. • Enabled data collection on the properties of high-atomic-number materials, such as uranium and plutonium, to inform assessment and certification of the stockpile.	• Advance understanding in key areas within megajoule yield and burning plasma science. • Start work to resolve uncertainties in laser-driven target performance. • Explore portion of the design space for laser-driven targets with alternative target drive approaches.	• Decrease supports highest-priority topics within ignition and burning plasma science studies and focuses efforts to explore some key target and drive configurations for laser-driven targets.

Inertial Confinement Fusion
ICF Diagnostics and Instrumentation

Description

The Inertial Confinement Fusion (ICF) Diagnostics and Instrumentation subprogram establishes new diagnostic capabilities and experimental support systems at the three national high energy density (HED) facilities through the research and development of specialized technologies necessary to execute experiments studying matter under extreme HED conditions. Diagnostics developed within this subprogram underpin the scientific advances made in support of all HED experimental application areas, including Assessment Science, nuclear survivability, and the pursuit of high fusion yield. They provide the key link between facility generation of HED conditions and the use of experimental data to validate models and resolve weapons physics issues. Improvements in diagnostic performance enable the extraction of essential physics phenomena of interest from complex and dynamic experiments. Recent investments in this subprogram have provided unprecedented experimental fidelity in the HED regime, allowing more useful information to be gained from each experiment, which is used by Assessment Science, Advanced Simulation and Computing, Stockpile Management, and other stockpile programs for successful execution of their respective Stockpile Stewardship and Management Plan responsibilities.

Priority activities across this subprogram include: advancing new technologies through design and engineering of transformational diagnostics that provide unprecedented information from HED experiments and can be used across the HED facilities; fielding diagnostics based on known technologies to address local needs and to achieve programmatic deliverables at each HED facility; and meeting HED experimental requirements through new experimental capabilities and operationally efficient support systems. Efforts to advance these activities also include development of experimental platforms that expand the performance range of the advanced laser- and pulsed-power facilities, new cryogenics capabilities such as improved handling and positioning systems or improved control layer quality systems, and new experimental capabilities such as improved laser diagnostics for accuracy or beam balancing. Many of these developments, particularly the transformational diagnostics, are advanced through coordinating efforts and sharing expertise across the HED facilities.

Highlights of the FY 2023 Budget

- Research and develop highest-priority transformational diagnostics at the three national HED facilities to improve the fidelity of data for studying physical phenomena relevant to stockpile work. This may include:
  - Developing next-generation high resolution velocimeters for NIF and Omega to measure material properties at extreme conditions.
  - Developing Wolter and toroidal hard x-ray imagers at NIF to discern hot spot temperature with temporal and spatial resolution.
  - Finishing a prototype diagnostic for time resolved diffraction on NIF and assessing detector options for Omega.
  - Developing next-generation hybrid CMOS sensors to increase measurement sensitivity at NIF, Z, and Omega.
  - Installing gamma reaction history diagnostic on Z to support Assessment Science experiments.
- Improve, field, and maintain key required local diagnostics and associated support systems to effectively execute experimental activities by capturing key data that will validate physics codes and reduce uncertainties in assessing nuclear weapons performance. This includes improving x-ray detectors, imagers, and spectrometers (radiation hardening, imaging at high yield, time-resolution), optical diagnostics (streak cameras, VISAR), and nuclear diagnostics (burn history, neutron time of flight detectors, stagnation diagnostics, fusion yield).
- Develop new experimental capabilities and diagnostic support systems to include work on target systems and infrastructure support capabilities, cryogenic systems and gas fill operation improvements, and improvements on laser accuracy/performance and optics performance.

FY 2024 – FY 2027 Key Milestones

- Develop and deploy transformational diagnostics, according to the National Diagnostics Plan, which will help acquire unprecedented information related to materials data, complex hydrodynamics, radiation flow and effects, and thermo-nuclear burn physics data.
- Develop and deploy local diagnostics as well as their associated analysis packages that can operate in harsh HED environments necessary in understanding radiation physics and the behavior of matter in the HED regime that are

critical to predicting the performance of nuclear weapons and understanding both primary and secondary nuclear weapon physics.
- Develop and deploy new experimental capabilities and diagnostic support systems that provide improved efficiency and better performance.
- Collaborate between NIF and Z to deploy additional diagnostics on Z fully utilizing the capabilities of their pulsed power system.

FY 2021 Accomplishments
- Generated the first reconstructed carbon gamma ray image produced from a NIF deuterium-tritium layered implosion, providing information about the shape of the ablator material at peak compression. This work supported a FY 2021 program milestone.
- Obtained first data on NIF using a Tantalum L-shell spectrometer. This is an important step for developing a plutonium capability by mid-FY 2024.
- Obtained the final data set required to commission the added gamma imaging capability on the third line of sight active neutron imaging system, meeting the FY 2021 program milestone; this added capability lays the groundwork to provide the spatial distribution of the production of the primary neutrons, shape of the cold dense deuterium-tritium fuel, and the remaining ablator at peak neutron production. Three-dimensional data is important for model validation of ICF implosions.
- Demonstrated significant reduction in background signals using a new shield design with the time resolved x-ray diffraction prototype, which will be used to develop a future multi-frame x-ray diffraction capability.
- Successfully tested radiation-hardened CMOS cameras on three high yield (greater than 2×10^{16} neutrons) NIF shots.
- Completed fabrication run for Daedalus read out integrated circuit to enable new spectroscopic measurements on Z and NIF.
- Commissioned a new symmetric cryogenic target cooling capability on Z. The multi-year effort decreased the temperature gradient and will enable advanced fuel configurations for ICF and Assessment Science platforms on Z.
- Recorded first high-quality, gated radiograph with the ultrafast x-ray imager system on a dynamic screw pinch experiment.
- Held joint requirements reviews between SNL and LLNL for a precision neutron time-of-flight diagnostic to improve ion temperature measurements and to quantify the residual kinetic energy in the burn phase of an ICF implosion and for a streak camera to measure fast x-ray emission with almost 100 times faster temporal resolution that current capabilities. This is a part of the collaboration to “transfer” diagnostic capabilities from NIF to Z.
- Completed first research and development phase to create a new image plate scanner for Z, NIF, Omega, and NRL and AWE partners.
- Employed the new Scattered Light Uniformity Imager (SLUI) diagnostic to understand and model the scattered light and resulting drive nonuniformity resulting caused by the Omega polarization rotators via cross beam energy transfer modulations.
- Acquired dynamic radiographs using a new Fresnel Zone Plate imager for measuring instability growth at a shock driven plastic/foam interface with unprecedented spatial resolution (1 µm).

ICF Diagnostics and Instrumentation
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
ICF Diagnostics and Instrumentation $73,014,000	**ICF Diagnostics and Instrumentation $67,597,000**	**ICF Diagnostics and Instrumentation -$5,417,000**
• Implemented the National Diagnostic Plan by developing transformational diagnostics and any associated technologies or support systems to ensure high-fidelity data of key physics phenomena relevant to stockpile work. This includes work on next-generation fast, efficient, high resolution x-ray detectors; new time-resolved x-ray platforms, to understand the evolution of material structure and strength at high pressure; three-dimensional photon and neutron imaging, to fully reconstruct non-symmetric implosions; and diagnostics to obtain data on the properties of high-atomic-weight materials in new weapon-relevant high energy density (HED) regimes, to support annual assessment and life extension activities. • Deployed new local diagnostics required by HED facilities to effectively support execution of experimental activities by capturing key data that will validate physics codes and reduce uncertainties in assessing nuclear weapons performance.	• Develop highest-priority transformational diagnostics to include: developing next-generation high resolution velocimeters for NIF and Omega to measure material properties at extreme conditions; developing Wolter/toroidal hard x-ray imagers at NIF to discern hot spot temperature; finishing a prototype diagnostic for time resolved diffraction on NIF and assessing options for Omega; developing next-generation hybrid CMOS sensors to increase measurement sensitivity at NIF, Z, and Omega; and installing gamma reaction history diagnostic on Z. • Improve, field, and maintain key required local diagnostics and associated support systems to effectively execute experimental activities by capturing key data that will validate physics codes and reduce uncertainties in assessing nuclear weapons performance. This includes improving x-ray detectors, imagers, and spectrometers (radiation hardening, imaging at high yield, time-resolution), optical diagnostics (streak cameras, VISAR), and nuclear diagnostics (burn history, neutron time of flight detectors, stagnation diagnostics, fusion yield). • Develop new experimental capabilities and diagnostic support systems to include work on target systems and infrastructure support capabilities, cryogenic systems and gas fill operation improvements, and improvements on	• Decrease supports the highest-priority diagnostics and instrumentation activities and represents a reprioritization of resources to support higher priority NNSA programmatic efforts.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
	laser accuracy/performance and optics performance.	

Inertial Confinement Fusion
Facility Operations

Description
The ICF Facility Operations subprogram supports the suite of ICF experimental and design facilities, which provide high energy density (HED) capabilities and platforms for weapons physics and development of next-generation capabilities. The NIF, Z, and Omega HED facilities, as well as advanced target design facilities at LANL, play a critical role in exploring material properties, hydrodynamics, weapon output, effects, and survivability, platform and diagnostics development, ignition, and high yield. The NNSA ICF facilities continue to push the boundaries of HED science. As the best-in-class facilities in the world, they also serve to attract and challenge some of the nation's best physicists and engineers to the nuclear security enterprise.

ICF Facility Operations provides not only the facilities, but also diagnostics and targets essential to meet the experimental demands of the national HED experimental plans. Diagnostic capabilities become part of the facility operations after the design stage is complete. Proper fielding, upkeep, and calibration of these diagnostics is required to maintain high-fidelity measurements and data expected to meet research objectives. Target fabrication is a key component of SSP experiments on NNSA's major HED facilities including NIF, Omega, and Z. The target is at the heart of the experiments and its designs and details change based on the goals of the program, with over 200 new designs yearly. The recent advances at NIF have highlighted the effects of capsule imperfections as well as the attention required for successful mitigation techniques of managing necessary capsule non-uniformities such as fill tubes and positioning. Advanced target designs are being pursued at all facilities to explore aspects of energy coupling and to provide experimental platform for stockpile mission experiments. Funded through ICF Facility Operations, target production and research include ongoing work at both NNSA laboratories and contractors to advance the ICF capabilities.

The ICF facilities are aging and have urgent needs for refurbishment to sustain the level of precision and system deliverables required to continue to advance yield and performance boundaries. Needs beyond routine maintenance have been identified in each facility's Sustainment Plan. For example, at NIF some systems, such as the main amplifiers and final optic systems, are experiencing damage and degradation due to debris. The debris sources must be eliminated, and the existing optical assemblies must be removed, refurbished, or replaced. Other systems such as the control system's embedded controllers have become obsolete and are no longer supported by industry so must be replaced. At Z, legacy systems such as insulating oil, water, and gas systems require updates. A major concern for continued operations past 2030 is the degradation of components in the Z Energy Storage system including more than 2,000 capacitors. Over the next five years, a significant investment will be made to sustain the ICF facilities and assure their continued contributions to stockpile stewardship in the 2030s.

Activities of facility operations are identified by operations, maintenance, load and target consumables, and the research and engineering required to sustain the facility capabilities.

- **Operations:** Operation of the ICF facilities includes executing a shot or preparing for and/or recovering from a shot as well as the facility preparation and pre-/post-shot reviews necessary to assure that shots are machine-safe and optimized to achieve the user's goals. Advanced target facilities at LANL also provide unique access to new regimes of programmatic relevance.
- **Maintenance:** Each of these precision ICF facilities require a high level of maintenance, including the categories of preventative maintenance, reactive maintenance, and reliability/efficiency improvements. Preventative maintenance is routine maintenance intended to keep a system working properly. Reactive maintenance describes work to fix things that are broken or impaired, including deferred maintenance. Reliability and efficiency improvements incorporate minor system improvements to enhance reliability and/or efficiency but do not include significant improvements or new capabilities.
- **Loads/target consumables:** The loads and targets for experiments at ICF facilities require careful preparation and construction for each. These include the consumables of experimental campaigns as well as refurbishments necessary for key load/target hardware which is routinely refurbished or repaired.

- **Sustaining capabilities:** Assuring continued high performance and reliability is key to optimal scientific output. Each of the ICF facilities is over 10 years old and requires ongoing refurbishment including replacing obsolete and unmaintainable systems with updated equipment that utilizes technology improvements and implement reliability and efficiency upgrades to improve facility productivity. Independent of improvements to energy and power, the NIF, Z, Omega, and LANL facilities require a range of sustainment investments that the program is in the process of prioritizing. Such updates will be required to enable another decade of stockpile science on ICF facilities.

Assessment Science, Advanced Simulation and Computing, Stockpile Management, Weapons Survivability, and other stockpile program elements, as well as external mission partners including Defense Threat Reduction Agency and the United Kingdom's Atomic Weapons Establishment (AWE), are informed by, access, and benefit from the capabilities developed by this subprogram to successfully meet SCDS pegposts and execute the NNSA Stockpile Stewardship Management Plan.

Highlights of the FY 2023 Budget

- Provide operational facilities to obtain the key data that reduce uncertainty in calculations of nuclear weapons performance.
- Obtain data on the properties of high atomic-weight materials, such as uranium and plutonium, in new weapon-relevant HED regimes using the Z at SNL and the NIF at LLNL.
- Continue safe and efficient operation of all NNSA-funded national HED facilities in accordance with their Governance Plans.
- Advance unique target design and development capabilities at LANL.
- Support the highest-priority HED experimental needs, within assessment science, nuclear survivability, and the pursuit of multi-MJ yield at NIF, Z, and Omega.
- Explore technology to support future facility investments, such as new approaches to energy balance, laser plasma instabilities (LPI), and improved energy coupling.

FY 2024 – FY 2027 Key Milestones

- Execute experiments approved by ICF program management and the combined HED/ICF Council is the top priority for the Facility Operations funding. Delivering on this priority requires well-maintained and calibrated facilities, quality targets, calibrated diagnostics, and highly skilled staff to execute the highly complex and precise HED experiment schedules.
- Assure that core experimental capabilities are proactively maintained by executing refurbishment and recapitalization of key ICF facility systems necessary to sustain performance levels of ICF facilities.
- Mitigate implosion degradation mechanisms through target advancements.
- Increase Pu capabilities at number of experiments on both Z and NIF.

FY 2021 Accomplishments

- **Experiments executed on NNSA's HED facilities:**
  - NIF experiments: 370; Z experiments: 104; Omega/Omega-EP experiments: 2,084 (estimated FY 2021 shots, based on experimental plans).
- **High impact stockpile stewardship experiments:**
  - A record yield of 1.3MJ was created from a deuterium-tritium fusion experiment on NIF.
  - NIF provided nuclear survivability tests examining cold x-ray response of materials under a range of different fluences was critical to a collaboration between AWE, the UK Ministry of Defense, the U.S. Navy, DTRA, Naval Research Lab, and LLNL. In addition to measuring the response of 2D coupons, new this year was the first measurement on the x-ray response of a complex, three-dimensional, scaled test object.
  - Experiments executed on the NIF provided data on the co-propagating shocks to validate modeling complex hydrodynamics in ICF.
  - Experiments at the Omega extended performance (EP) laser studying a high explosive (TATB) will guide future NIF shot.

- **New or improved capabilities developed on HED facilities:**
  - Demonstrated success with a new Z platform that provides more data and higher peak pressures for plutonium studies.
  - Mitigated capsule support effects by routine alternate capsule support.
  - Developed multiyear plans for facility sustainment of Z, NIF, and Omega.
  - Demonstrated mitigation of stimulated Brillouin scattering (SBS) through use of a new 4-color capability on NIF consistent with predictions, opening greater parameter space for ignition designs.
  - Commissioned a High-Density Carbon (HDC) capsule coating and polishing capability at LLNL to allow for research and development of mitigations to HDC capsule imperfections.
  - Demonstrated Fourth-generation Lasers for Ultra-broadband Experiments (FLUX) technology through testbed laser experiments which have applications to mitigate LPI and provide improved beam smoothing for direct-drive ICF.

Facility Operations
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Facility Operations $387,194,000	**Facility Operations $371,779,000**	**Facility Operations -$15,415,000**
• Maintained safe and efficient operations at all the national HED facilities: NIF, Z, and Omega. • Emphasized experiments in direct support of the stockpile and implementation of the findings and recommendations of ICF 2020 and JASON reviews.	• Begin refurbishment and recapitalization of most critical systems as identified in facility sustainment plans. • Continue safe and efficient operation of all NNSA-funded national HED facilities in accordance with their Governance Plans. • Support the highest-priority HED experimental needs within assessment science, nuclear survivability, and the pursuit of multi-MJ yield at NIF, Z, and Omega. • Advance unique target design and development capabilities at LANL.	• The decrease will support most critical facility refurbishment needs to assure continued operations.

Stockpile Research, Technology, and Engineering
Advanced Simulation and Computing

Overview

The Advanced Simulation and Computing (ASC) program provides high-end simulation capabilities (e.g., modeling codes, computing platforms, and supporting infrastructure) to meet the requirements of the SSP. Modeling the complexity of nuclear weapons systems is essential to maintaining confidence in the performance of our stockpile without underground nuclear testing. The ASC program provides the weapon codes that provide the integrated assessment capability supporting annual assessment and future sustainment program qualification and certification of the stockpile. ASC is an integral element of the Stewardship Capability Delivery Schedule (SCDS). ASC provides critical capabilities that help inform decision-making related to the sustainment of the nuclear stockpile in support of U.S. national security objectives. The program also coordinates with NNSA and other government agencies, including the Intelligence Community, to support nonproliferation, emergency response, nuclear forensics, and attribution activities.

The ASC computing capabilities are the key integrating mechanism across the nuclear weapons program through the Integrated Design Codes (IDCs), which contain mathematical descriptions of the physical processes of nuclear weapons systems and functions. Combined with weapon-specific data, these IDCs support high-fidelity, physical models used to carry out design studies, maintenance analyses, the Annual Assessment Reports, sustainment programs, SFIs, and weapons dismantlement activities, all without additional underground explosive nuclear testing. The IDCs currently perform well for general mission-related activities. However, issues such as aging, potential new threats, and new manufacturing techniques require IDCs with new, enhanced-fidelity physical models that use high-performance computing (HPC) resources more effectively. ASC capabilities that support the stockpile stewardship mission were built on the computing technologies commercially available for the past two decades. To provide increased computing power for general consumer markets, industry has evolved beyond that scientific-computing-technology paradigm. ASC must maintain currency with the computing industry to ensure continued performance of the IDCs on the next-generation compute platforms, as required to maintain a credible nuclear deterrent and address potential additional mission needs in non-proliferation, emergency response, nuclear forensics, and attribution programs.

In addition to these capabilities, the ASC program is advancing several internal initiatives, or special projects, to leverage developing technologies and capabilities to support the sustainment of the nuclear stockpile. ASC established the Large-Scale Calculations Initiative, currently underway, to determine the limitations and scaling potential of our current assessment capabilities. This initiative assesses the potential of current HPC platforms, codes, and qualified personnel by exploring physics calculations that are impractical for regular assessment capabilities due to job sizes, time length of the code runs, or a combination of the two. The initiative pushes the national security laboratories to look beyond current computing abilities to make today’s hero calculations those of routine business soon for a variety of NNSA missions. Another effort is the Advanced Machine Learning Initiative (AMLI), which aims to increase the use of commercially available artificial intelligence hardware and further develop machine learning algorithms to add to the ASC physics-informed simulation portfolio. This initiative can significantly increase efficiency, improve models to better match experimental data, and tighten the integration of multi-scale and multi-dimensional models, while addressing concerns with validation of these techniques when new errors are introduced. Another initiative across the national security laboratories is quantum computing (QC), which seeks to develop new methods and expertise in algorithm development and hardware evaluations to develop promising QC technologies suitable for nuclear weapon applications. The ASC program aims to drive efficiencies into the manufacturing process through ASC’s Production Simulation Initiative (PSI). Efforts such as the Simulation First initiative at KCNSC incorporates physics-based simulation into production operations to optimize solutions.

The Advanced Simulation and Computing program is composed of six subprograms:

1. **Integrated Codes** produces large-scale, IDCs that allow the performance of detailed nuclear weapons assessments without the need for additional nuclear explosive testing.
2. **Physics and Engineering Models** provides the models and databases used in simulations supporting the U.S. stockpile.
3. **Verification and Validation** brings the Integrated Codes and Physics and Engineering Models subprograms of ASC together with the Stockpile Management program to evaluate the capability of IDCs.

4. **Advanced Technology Development and Mitigation** addresses the need to build new IDCs that are more aligned with emerging, next-generation system architectures and to develop next-generation computing technologies and software.
5. **Computational Systems and Software Environment** builds an integrated, balanced, and scalable computational capabilities, including HPC systems and requisite software stacks.
6. **Facility Operations and User Support** provides the facilities and user services required to enable nuclear weapons simulations.

Advanced Simulation and Computing
Integrated Codes

Description

The Integrated Codes (IC) subprogram produces large-scale IDCs that enable detailed nuclear weapons assessments without the need for additional underground nuclear explosive testing. They are the codes used for physics and engineering stockpile assessments to support concept studies, certification, maintenance analyses, LEPs, Alts, SFIs, and weapons dismantlement activities. The IDCs represent a repository of knowledge gained from experiments on NNSA's wide range of facilities, legacy nuclear explosive tests, enhancements made to support the Stockpile Management program, and a variety of other critical national security missions. These codes enable nuclear forensics, foreign assessments, and device disablement techniques related to nuclear counter-terrorism efforts and the study of nuclear weapons behavior in normal, abnormal, and hostile environments, as well as outputs to enable effects estimates.

The IC subprogram also maintains select legacy codes and is responsible for ancillary tools that support the weapons mission. These specialized codes enable simulation workflow, generate models or information used by the IDCs, and validate the IDCs by comparison with experimental data obtained from facilities, such as Z and NIF. In this way, IC serves an integrating tool for activities across SRT&E.

Long-term technical goals for the IC subprogram are to provide credible simulation capabilities that cover all the relevant physics and maximize performance on current and future ASC computing platforms. These goals are achieved through collaborative activities with the Physics and Engineering Models (PEM), Verification and Validation (V&V), and Computational Systems and Software Environment (CSSE) subprograms and experimental programs in the Office of Experimental Sciences. The IC subprogram will prepare for the more complex and heterogeneous node architecture of upcoming high-performance computing (HPC) platforms through advances achieved by the Advanced Technology Development and Mitigation (ATDM) subprogram.

Highlights of the FY 2023 Budget

- Continue to provide weapons code capabilities to the NNSA nuclear security enterprise for annual assessments, SFI investigations, LEP qualification and certification, and related nuclear security assessments.
- Continue porting of current and next-generation integrated design codes to the El Capitan early access system-3 (EAS-3) nodes, which will have one-generation-earlier graphics processing units (GPUs) than what will be deployed in the final El Capitan system.
- Support production agencies using ASC codes and computing resources as part of the Production Simulation Initiative (PSI).

FY 2024 – FY 2027 Key Milestones

- Develop and deploy a production-level simulation capability to perform assess and develop mitigation strategies for hostile encounters.
- Continue developing and evaluating next-generation weapons code technologies on advanced architecture systems to identify and address remaining performance and portability issues.
- Continue developing and deploying science-based modeling capabilities to drive efficiency and productivity between the design and production agencies as part of the PSI, including working closely with V&V for embedded UQ to enable virtual design cycles.
- Provide high-fidelity codes to simulate new materials in relevant reentry environments.

FY 2021 Accomplishments

- Maintained full baselines for all stockpile systems and used these baselines to improve the fidelity of annual stockpile assessments.
- Advanced nuclear performance assessment codes for boost and secondary performance; safety codes to address multi-point safety issues; and engineering assessment codes for hostile, normal, and abnormal environments.
- Adapted existing codes to new HPC architectures and migrate current design and safety codes to run efficiently on heterogeneous computing architectures.

Integrated Codes
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Integrated Codes $137,956,000	**Integrated Codes $155,556,000**	**Integrated Codes +$17,600,000**
• Continued development of existing and next-generation integrated codes to support nuclear performance assessments for boost and secondary performance, safety to address multi-point safety issues, engineering assessment for hostile environments, and engineering assessment for normal and abnormal environments. • Migrated current design and safety codes to run efficiently on heterogeneous architectures. • Supported KCNSC's on-going use of ASC codes and computing resources to solve production manufacturing problems. • Continued with code builds and ports, testing and bug fixes.	• Further develop existing and next-generation integrated codes to support stockpile sustainment, for stockpile modernization, including performance in relevant environments, and relevant safety issues. • Develop and deploy simulation tools to be utilized by production agencies. • Support analysts and designers in utilization of the updated integrated design codes. • Port current and next-generation integrated design codes to the El Capitan early access system-3 (EAS-3) nodes.	• Increase provides support for ATDM simulation capabilities to be productionized and sustained by IC.

Advanced Simulation and Computing
Physics and Engineering Models

Description

The Physics and Engineering Models (PEM) subprogram provides the models and databases used in simulations supporting the U.S. stockpile. These models and databases describe a wide variety of physical and engineering processes occurring in a nuclear weapon lifecycle. The capability to accurately simulate these processes is required for annual assessment; design, qualification, and certification of warheads undergoing sustainment programs; resolution (and in some cases generation) of SFIs; and the development of future stockpile technologies. The PEM subprogram is closely linked to the Assessment Science program within the SRT&E, which provides the experimental data that informs development of new models used in simulation codes.

The PEM subprogram's responsibilities are threefold: 1) to provide mathematical models and databases to represent physical behavior and physical data (e.g., Equation of State (EOS), strength parameters, radiation opacities and nuclear cross-sections) for use in the IDCs; 2) to collaborate with the IC subprogram to implement these models and data in the IDCs; and 3) to collaborate with the Verification & Validation (V&V) subprogram to ensure the models have been implemented correctly (verified) and have been compared to experimental data (validated).

Highlights of the FY 2023 Budget

- Support survivability and hostile environment modeling across current and future high-performance computing systems.
- Revamp foundational materials modeling infrastructure to fully support and utilize next-generation architectures.
- Improve physics models relevant to full range of applications. This includes improved modeling of multi-physics response to combined abnormal environments, expanding current inline opacity capabilities to support modeling certification efforts and hostile environments, and implementing phase-aware material models for strength and ejecta.
- Continue to improve and deploy modeling capabilities to positively impact production requirements as part of PSI.

FY 2024 – FY 2027 Key Milestones

- Extend physics models and simulation methodologies for evaluation of weapon performance and response in relevant environments.
- Work with V&V and in support of the Advanced Machine Learning Initiative, developing credible and interpretable machine learning toolkits to enable physics-constrained ML models with quantifiable uncertainties and holistic data assessments.
- Provide age-aware physics models to update lifetime assessments in the AAR.
- Create an infrastructure for foundational materials modeling and calibration that fully utilizes advanced features of next-generation architectures, ML techniques, and experimental full-field data.

FY 2021 Accomplishments

- Developed methods to characterize explosives in support of the W80-4 LEP.
- Quantified sensitivity of yield and criticality to a wide range of primary design parameters.
- Concluded the 3rd Sandia Fracture Challenge, with a focus on reliability of additively manufactured metals. The challenge elicited responses from 22 international teams using a variety of computational approaches to link material structure to performance of an additively manufactured component loaded to failure.
- Developed and implemented models of common circuit failure mechanisms to aid in the qualification of commercial off-the-shelf parts and can be used to predict deterioration on performance and ultimate failure of application-specific integrated circuits as a function of aging.

Physics and Engineering Models
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Physics and Engineering Models $77,967,000	**Physics and Engineering Models $77,804,000**	**Physics and Engineering Models -$163,000**
• Revamped and further developed material models and infrastructure to fully support and utilize El Capitan. • Furthered refinement and improved credibility of predictive models for manufacturing processes, including pre-production and post-production processes. • Developed machine learning toolkits to enable physics models in areas such as strength/damage and nuclear data. • Furthered refinement of models to enable assessments of future stockpile options • Supported production agencies in the use of ASC models to solve production manufacturing problems. • Developed mission-relevant quantum simulation algorithms.	• Support survivability and hostile environment modeling across current and future HPC systems. • Utilize foundational materials modeling infrastructure to fully support El Capitan, in addition to preparing for other advanced architectures. • Improve and deploy modeling capabilities to positively impact production requirements as part of PSI. • Develop age-aware physics models. • Develop and refine mission-relevant quantum simulation algorithms.	• Slight decrease reflects redirection of resources to enhance next-generation code development in preparation for EAS-3 access.

Advanced Simulation and Computing
Verification and Validation

Description

The Verification and Validation (V&V) subprogram provides evidence that the models in the codes produce mathematically credible answers that reflect physical reality. V&V focuses on establishing soundness in integrated simulation capabilities by collecting evidence that the numerical methods and simulation models are being solved correctly and whether the simulation results from mathematical and computational models implemented into the codes are in alignment with real-world observations. The V&V subprogram funds the critical skills needed to apply systematic measurement, documentation, and demonstration of the ability of the models and codes to predict physical behavior.

V&V brings the IC and PEM subprograms together with other SRT&E activities to evaluate the capability of the IDCs. Verification activities demonstrate that the IDCs and PEM models are correctly solving their respective governing equations. Validation activities ensure that both science codes and IDCs are solving the equations accurately, and that the models themselves are sufficiently precise for the intended application. Together, these subprogram activities provide a technically rigorous, credible, and sensible foundation for computational science and engineering calculations by developing, exercising, and implementing tools that provide confidence in the simulations of high-consequence nuclear stockpile problems.

Highlights of the FY 2023 Budget

- Improve necessary next-generation verification and validation techniques to continue support in methods, assessments, and data archiving.
- Continue extending the verification and validation infrastructure to include next-generation integrated design codes.
- Support advancement of V&V and Uncertainty Quantification (UQ) suites to support the current stockpile integration of common modeling workflows.
- Integrate test suites into existing workflows for supporting a broad customer base.
- Demonstrate improved and validated nuclear data from machine learning techniques demonstrated into material response and plasma models.
- Implement the Engineering Common Model Framework to enhance common modeling techniques for ASC capabilities.

FY 2024 – FY 2027 Key Milestones

- Utilize capabilities to evaluate the fidelity of the simulation tools in collaboration with integrated codes, model development, and weapon application communities.
- Develop Engineering Common Modeling Frameworks with integrated V&V/UQ and sensitivity analysis.
- Collaborate with PEM to support the development of credible and interpretable machine learning toolkits to enable physics-constrained ML models with quantifiable uncertainties and holistic data assessments.
- Establish a V&V/UQ framework and workflows to support the credible application of next-generation codes on current and emerging platforms.
- Enhance provision of tools and methodologies for estimating the uncertainty in weapon simulation results from the IDCs.

FY 2021 Accomplishments

- Established a model for resource scaling with end-to-end analysis for prototyping intrinsic credibility in analysis workflows.
- Developed a baseline thermal model within Next Generation Workflow project for the Engineering Common Model Repository for the B83 system.
- Applied processing codes on nuclear data variations to produce thermalized, multi-grouped libraries to support next-generation nuclear data UQ efforts.
- Provided training on the use of UQ tools, aided by initial advanced machine learning techniques.

Verification and Validation
Activities and Explanation of Changes

<table>
<tr><th>FY 2021 Enacted</th><th>FY 2023 Request</th><th>Explanation of Changes
FY 2023 Request vs
FY 2021 Enacted ($)</th></tr>
<tr><td>Verification and Validation $61,676,000</td><td>Verification and Validation $58,678,000</td><td>Verification and Validation -$2,998,000</td></tr>
<tr><td>
• Continued to verify and validate improvements in nuclear performance and safety codes to address multi-point safety issues.
• Validated improvements to physics and material models.
• Validated improvements in engineering codes for normal, abnormal, and hostile environments.
• Adopted new V&V protocols for algorithms running on heterogeneous HPC architectures.
• Advanced predictive capability of codes and models.
• Improved existing and developed new primary and secondary common models.
• Provided training on the use of UQ tools, aided by initial advanced machine learning techniques.
• Implemented quality assurance controls to ensure material and nuclear databases are correctly updated and maintained.
</td><td>
• Improve necessary next-generation verification and validation techniques to continue support in methods, assessments, and data archiving.
• Enhance V&V protocols for algorithms running on hybrid HPC architectures.
• Develop and provide training on the use of new and existing UQ tools.
• Implement quality assurance controls to ensure material and nuclear databases are correctly updated and maintained.
• Develop and refine the primary and secondary common models.
</td><td>
• Decrease reflects a redirection of resources to enhance integration of ASC models and codes.
</td></tr>
</table>

Advanced Simulation and Computing
Advanced Technology Development and Mitigation

Description

The Advanced Technology Development and Mitigation (ATDM) subprogram is transitioning laboratory code and computer engineering/science projects, supporting long-term simulation and computing goals relevant to both exascale computing and the broad national security missions of NNSA, to the other ASC subprograms as these tools and capabilities will support code usability for broader mission applications. In prior years, this subprogram had addressed the need to build new IDCs that are more aligned with emerging technologies and to engage in co-design collaborations with industry to evolve the HPC operating systems and development software so that next-generation weapons codes will perform well on future HPC systems.

The current ASC simulation capabilities are encountering a computing paradigm change as HPC technologies evolve to radically different and more complex (many-core or heterogeneous) architectures. This subprogram addresses three major challenges: 1) the radical shift in computer system architectures, 2) maintaining current IDCs that took more than a decade to develop and validate, and 3) adapting current capabilities as evolving computing technologies become increasingly disruptive to the IDCs.

As the ATDM work scope is being transitioned to other ASC subprograms, it continues to seek solutions for remaining issues associated with evolving system architectures.

Highlights of the FY 2023 Budget

- Develop additional capabilities and harden user software technologies to prepare for transition to ASC Computational Systems & Software Environment subprogram in FY 2024.

FY 2024 – FY 2027 Key Milestones

- The subprogram will achieve its objectives in FY 2024.

FY 2021 Accomplishments

- Sustained the portfolio of the ATDM subprogram and matured simulation capabilities to evaluate hostile environment response, along with accelerated development of next-generation IDCs and mission-support software stack.

Advanced Technology Development and Mitigation

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Advanced Technology Development and Mitigation $40,000,000	**Advanced Technology Development and Mitigation $12,000,000**	**Advanced Technology Development and Mitigation -$28,000,000**
• Sustained ASC investment in the DOE Exascale Computing Project (ECP) for Application Development and Software Technology (ST) focus areas. • Coordinated activities associated with transitioning next-gen simulation capabilities with IC, PEM, and V&V subprograms, and adoption of next-generation computer science technologies by CSSE. • Continued Interagency CoDesign (ICD) activities with National Cancer Institute and biomedical industry.	• Continue funding NNSA-specific ECP ST projects in the Next-Generation Architecture and Software Development product group.	• Stand down the ATDM Next-Generation Code Development and Application (CDA) and ICD product groups.

Advanced Simulation and Computing
Computational Systems and Software Environment

Description

The Computational Systems and Software Environment (CSSE) subprogram builds a portfolio of integrated, balanced, and scalable computational capabilities to provide the needed computing environment stability to protect NNSA's investment in IDCs. In addition to the powerful Commodity Technology (CT) and Advanced Technology (AT) systems that the program fields, the supporting software infrastructure that is deployed on these platforms include many critical components, ranging from system software to input/output (I/O) services, storage and networking, post-processing (visualization and data analysis tools), and next-generation computing technologies. CSSE also examines possible future technologies beyond exascale, such as quantum, neuromorphic, and non-complementary metal-oxide-semiconductor (non-CMOS)-based computing techniques.

The CSSE subprogram provides the computational infrastructure, both hardware and software, necessary to support weapon applications, as follows:

- Design, develop, and deploy usable computing systems. The CSSE subprogram will design and procure HPC systems required to support stockpile stewardship and broader nuclear security missions. These systems will include test beds and early access systems for evaluation and analysis of code performance issues on next-generation hardware, CT systems for most stockpile computing work, and AT systems for large-scale simulation workloads and predictive science advances.
- Provide comprehensive, stable computing and development environments. The CSSE subprogram will also provide the system software and code development environments necessary for code development and simulation using the computing hardware.

Authorized by DOE Order 130.1A, ASC will use a lease-to-own funding vehicle for the Commodity Technology System, Advanced Technology System, and storage system procurements in situations that make programmatic and financial sense.

Highlights of the FY 2023 Budget

- Accept and deploy Crossroads full system for classified computing service.
- Accept and deploy an NNSA exascale system, ATS-4/El Capitan.
- Accept and deploy additional CTS-2 platforms at NNSA laboratories.
- Transition mature ATDM next-generation computer science capabilities into CSSE's Next-Generation Computing Technologies product group.

FY 2024 – FY 2027 Key Milestones

- Transition El Capitan into classified computing services.
- Deploy additional CTS-2 platforms at NNSA laboratories.
- Execute procurement of and deploy ATS-5 at LANL.
- Develop system software environment for ATS-5.
- Initiate CTS-3 procurement.
- Upgrade tri-lab software environment with exascale-class software technologies.

FY 2021 Accomplishments

- Transitioned the ASC Astra system into classified computing environment.
- Issued the ASC Crossroads system contract award.
- Initiated El Capitan non-recurring engineering contract with Hewlett Packard Enterprise (HPE) and AMD, as a joint collaboration with ORNL.
- Improved tri-lab software environment, as collaboration with vendor partners, to prepare for Crossroads and El Capitan systems.

Computational Systems and Software Environment
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Computational Systems and Software Environment $237,953,000	**Computational Systems and Software Environment $253,903,000**	**Computational Systems and Software Environment +$15,950,000**
• Prepared software environment for ASC Crossroads system at LANL. • Closely co-designed with HPE on El Capitan's non-engineering (NRE) activities. • Executed award for Vanguard-2 project, which is an applied R&D collaboration with a computer company. • Signed new contract for CTS-2 platforms for NNSA tri-labs. • Prepared tri-lab computing environment for El Capitan. • Deployed new quantum computing testbeds.	• Deploy ASC Crossroads full system at LANL. • Deploy El Capitan system. • Deploy CTS-2 platforms at NNSA laboratories and KCNSC. • Support tri-lab computing environment for Crossroads and El Capitan. • Accept the Vanguard-2 prototype system. • Manage the Advanced Memory Technology portfolio. • Continue evaluating applicability of quantum computing hardware for DP missions.	• Accept and deploy El Capitan system for a short tri-lab, open-science computing period.

Advanced Simulation and Computing
Facility Operations and User Support

Description

The Facility Operations and User Support (FOUS) subprogram provides the facilities and services required to support nuclear weapons simulation workloads. Facility Operations includes physical space, power, and other utility infrastructure, and Local Area/Wide Area Networking for local and remote access, as well as system administration, cybersecurity, and operations services for ongoing support. User Support includes computer center hotline and help-desk services, account management, web-based system documentation, system status information tools, user training, trouble-ticketing systems, common computing environment, and application analyst support.

The FOUS subprogram is responsible for management of the computer operations and maintenance and for system administration and user support. This includes:

- Effective management of computing hardware infrastructure. The FOUS subprogram will provide adequate power, cooling, and integrated facilities to support the computing system hardware, and it will provide the requisite networking and storage infrastructure.
- Responsive system administration, maintenance, and user support. The FOUS subprogram will administer the computational systems, manage the job scheduling capability, and provide responsive support to the user community.

Authorized by DOE Order 130.1A, ASC will utilize lease-to-own funding vehicles for Commodity Technology Systems, visualization cluster and storage system procurements in situations that make programmatic and financial sense.

Highlights of the FY 2023 Budget

- Prepare the ASC computing facilities at the NNSA laboratories for the next-generation platforms.
- Operate CTS2 platforms at the NNSA laboratories.
- Operate ATS-3/Crossroads at LANL, including remote computing capabilities.
- Operate El Capitan system as tri-lab resource during open-science period.

FY 2024 – FY 2027 Key Milestones

- Integrate El Capitan (ATS-4) into tri-lab, classified computing environment.
- Complete required building preparation for ATS-5 siting, including expanding the warm-water cooling system and electrical capacity at the Strategic Computing Complex (SCC) to enable up to 50MW of supercomputing.
- Operate ATS-5 and CTS-3 systems.
- Operate the Vanguard-2 platform as a tri-lab, production-level HPC system.
- Retire Sierra (ATS-2).

FY 2021 Accomplishments

- Completed construction of the CTS-2 chilled-water cooling capability in the Strategic Computing Complex at LANL.
- Established a new production unclassified restricted enclave at LANL for new HPC services in support of tri-lab Remote Computing Enablement (RCE) project.
- Continued production operation of Trinity (ATS-1) and CTS-1 systems Snow, Fire, Ice, and Cyclone in full production use, peaking with over 95% utilization and 99% system availability.
- Achieved 89% completion of the Exascale Computing Facility Modernization (ECFM) construction project at LLNL.
- Completed the B654 Low Conductivity Water Cooling Loop for future CTS platforms at LLNL.
- Installed power, cooling, and networking infrastructure for CTS-2 systems in conjunction with the 3MW power upgrade to the 725-East HPC Facility at SNL.
- Deployed Manzano, a CTS-1+ cluster, to the SNL Restricted Network.
- Purchased and distributed most of the equipment necessary for the NNSA Enterprise Secure Network (ESN) upgrade from 1Gbs to 10 Gbs in support of the tri-lab remote computing.

Facility Operations and User Support
Activities and Explanation of Changes

<table>
<tr><th>FY 2021 Enacted</th><th>FY 2023 Request</th><th>Explanation of Changes
FY 2023 Request vs
FY 2021 Enacted ($)</th></tr>
<tr><td>Facility Operations and User Support
$176,462,000</td><td>Facility Operations and User Support
$184,705,000</td><td>Facility Operations and User Support
+$8,243,000</td></tr>
<tr><td>• Maintained full operation of CTS1 and CTS1+ systems.
• Improved tri-lab common computing environment to include more heterogeneous architectures in the CTS environment.
• Maintained maximum availability of computer cycles to end users.
• Documented and implemented new best practices.
• Provided operational support for reliable and secure production computing environment.
• Prepared for insertion of next-generation architectures (systems and testbeds).
• Implemented contingency response plans, as necessary.
• Improved and deployed the needed file system and archival storage technologies.
• Supported execution of the LLNL Exascale Computing Facility Modernization project.</td><td>• Maintain full operation of CTS-2 systems.
• Maintain maximum availability of computer cycles to end users.
• Document and implement new best practices.
• Provide operational support for reliable and secure production computing environment.
• Prepare for insertion of next-generation architectures (systems and testbeds).
• Implement contingency response plans, as necessary.
• Demonstrate stable, production-level remote computing capabilities with Crossroads/ATS-3.
• Complete required building preparation for El Capitan/ATS-4.
• Support the installation and start of operations of El Capitan/ATS-4.
• Continue design and construction of additional power and cooling upgrades for SNL's 725-E HPC Facility.
• Continue to improve tri-lab common computing environment to include more heterogeneous architectures in the CTS environment.</td><td>• Increase reflects facility service preparation for FY 2023 operation of El Capitan, Crossroads, and CTS systems, while maintaining operations across tri-lab computing infrastructure.</td></tr>
</table>

Stockpile Research, Technology, and Engineering
Weapon Technology and Manufacturing Maturation

Overview

The Weapon Technology and Manufacturing Maturation program is responsible for developing agile, affordable, assured, and responsive technologies and capabilities for nuclear stockpile sustainment and modernization to enable Defense Programs' mission success and the future success of the nuclear security enterprise.

The core areas of work include:

- **Agile, Assured, and Affordable Technologies:** Developing and modernizing stockpile technologies and processes so the techniques are agile, assured, and responsive to change, shortening design, qualification, certification, and manufacturing cycles and timelines to improve future affordability.
- **Partnership with Stakeholders to Meet Stockpile and Customer Requirements:** Identifying, sustaining, enhancing, integrating, and continually exercising all capabilities, tools, and technologies across the science, engineering, design, certification, and manufacturing cycle, working together with the Department of Defense, national security laboratories, nuclear weapon production facilities, and other partners.
- **Qualification and Certification:** Collaborating with other Defense Programs partners to conduct experiments and simulations that enable qualification and certification without nuclear explosive testing.
- **Skilled Technical Workforce and Enhanced Capabilities:** Maintaining a qualified technical workforce and enhanced capabilities by transferring knowledge, skills, and direct experience with respect to all stockpile technologies and processes.

Primary responsibilities of this program include:

- Developing innovative technologies that both minimize the probability of unauthorized use and maximize reliability for authorized use.
- Leading technology and system demonstration efforts, with various mission partners, to speed development and improve acceptance of advanced technologies and processes into the stockpile and the nuclear security enterprise.
- Improving agility, effectiveness, safety, and efficiency in the design and manufacture of war reserve components using advanced technologies and manufacturing processes.

The Weapon Technology and Manufacturing Maturation program is made up of three subprograms:

1. **Surety Technologies** creates and matures options, internal and/or external to the warhead, to minimize the potential for deliberate unauthorized use of a U.S. nuclear weapon and maximizing the reliability of authorized use of a U.S. nuclear weapon while maintaining the highest levels of safety.
2. **Weapon Technology Development** funds activities associated with the development, engineering, and integration of technologies that ensure the reliable performance, safety, and handling of current and future stockpile systems. Technology demonstrations and related activities are also covered under this subprogram.
3. **Advanced Manufacturing Development** rapidly develops and deploys advanced manufacturing methodologies and processes that are responsive to the NNSA mission.

Weapon Technology and Manufacturing Maturation
Surety Technologies

Description

The Surety Technologies program is dedicated to simultaneously minimizing the probability of unauthorized use and maximizing the reliability of authorized use of a U.S. nuclear weapon while maintaining the highest levels of safety. Surety Technologies creates, develops, and matures advanced safety, security, and use-control or denial technologies to minimize the probability of an accidental nuclear explosion and, in the unlikely event that security fails and unauthorized access is gained, reduces the risk of an unauthorized nuclear yield to the lowest practical level.

Surety Technologies seeks advances in leading-edge technologies in two timeframes:

- Maturing near-term surety concepts and technologies to offer the most effective surety solutions for the enduring stockpile and future insertion opportunities achievable within the timelines of known weapon modernization schedules or other improvements that will maintain weapon functionality.
- Creating and evolving highly advanced surety technologies, independent of specific weapon types or insertion opportunities that can result in major surety improvements.

Surety Technologies incorporates national security guidance as outlined in the Presidential Policy Directive (PPD)–35; Department of Energy Order 452.1E, *Nuclear Explosive and Weapon Surety Program* and its new surety requirements; the NNSA Defense Programs surety strategy; and the 2010 JASON Surety Study findings and recommendations; in conjunction with the Joint Integrated Lifecycle Surety risk assessment capability to identify the most cost-effective surety technologies. This enables program and weapon system managers to make better-informed implementation decisions on stockpile surety improvement options.

Surety Technologies activities include:

Major Projects – Directed, high priority, and integrated research and development (R&D) efforts to support timely availability of advanced safety and security options for the stockpile. These are projects, usually multi-site, that are easily defined and required to integrate with entities outside the Surety Technologies program. They also have defined requirements for technology development and are held to integrated schedules. Major Projects represent a concerted effort by the Surety Technologies program to ensure novel technologies are properly integrated with and across programs and sites, leading to a high probability of achieving sufficient maturity for stockpile insertion.

Advanced Safety Projects – Maturing near-term safety technologies that offer the most effective solutions for the enduring stockpile and future insertion opportunities achievable. Directed and high priority integrated research and development efforts and multi-site projects intended to minimize the probability of accidental nuclear yield or dispersion of fissile material. Develops improved control over warhead initiation, including improved stronglinks, weaklinks, firing systems, and high explosive initiation systems, to provide nuclear weapon safety.

Advanced Security Projects – Directed and high priority integrated R&D efforts and projects that create and mature options, internal and/or external to the warhead, to minimize the potential for deliberate unauthorized use of a U.S. nuclear weapon and ensure authorized use. Develops and demonstrates advanced system concepts and associated enabling technologies that could integrate weapon capabilities with physical security.

Technology Development – Advanced safety and security projects meant to advance the state of the art and to improve the building blocks of the Surety Technologies program. These efforts are technology-focused and are not held to a development schedule but to an integrated schedule or to commitments with outside entities. Technology Development projects form the base from which Major Projects draws to create new, integrated technologies for the stockpile.

Advanced Safety Technology Development – Technology development safety efforts intended to minimize the probability of accidental nuclear yield or dispersion of fissile material. Develops improved control over warhead initiation to provide nuclear weapon safety.

Advanced Security Technology Development – Creates and matures security options, internal and/or external to the warhead, to minimize the potential for deliberate unauthorized use of a U.S. nuclear weapon and ensure authorized use. Develops and demonstrates advanced or new system concepts and associated enabling technologies that could integrate weapon capabilities with physical security.

Highlights of the FY 2023 Budget

- Develop optical initiation systems and support the Optical Initiation Technology Realization Team, a collaborative effort between the laboratories and plants created to ensure the successful rapid maturation of optical initiation as that technology eventually transitions to production and insertion into the next weapons systems.
- Develop advanced safety mechanisms and demonstrate technologies on the next appropriate demonstrator.
- Develop improved safety architectures that minimize/eliminate issues with inadvertent electrical transmission.
- Develop improved power management technologies tailored to modernized applications.

FY 2024 – FY 2027 Key Milestones

- Demonstrate a mature optical initiation system, TRL 5 & MRL 3, for next insertion option such as the next Navy warhead.
- Continue focused development of a multi-point safety design concept that can be qualified for a future insertion opportunity.
- Continue limited development of improved power management technologies tailored to modernized applications.
- Develop advanced safety mechanisms and demonstrate technologies on a relevant demonstrator.
- Develop improved safety architectures that minimize/eliminate issues with inadvertent electrical transmission.

FY 2021 Accomplishments

- Completed the construction of the requisite hardware for a full-scale demonstration of the optical initiation system on a ground-based demonstration. Also completed the electrical and mechanical systems required for two upcoming flight tests, one that will be aboard a commercial rocket that will provide useful and relevant test data.
- Moved a commercially available machine to the KCNSC in support of the production of NextGen technology.
- Provided surety related support to the U.S.-UK Joint Technology Demonstrator project for their ground test unit.
- Continued to near competition the required engineering features of an existing Multi-Point Safe (MPS) design concept to address manufacturing and effectiveness concerns.
- Continued to collect data from the full-scale MPS experiment; evaluated the full-scale aging samples against the accelerated small test samples and continued to find no deviation between the experiments.
- Initiated the construct of a tri-lab surety roadmap sufficient to accomplish the surety requirements in the new DOE Order 452.1E.
- Integrated specialized memory chipsets into a use-control design concept that will allow for unique control concepts.
- Completed a comprehensive comparison study of several competing power management technologies that will serve as guidance for future development activities.

Surety Technologies
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Surety Technologies $54,365,000	**Surety Technologies $51,497,000**	**Surety Technologies -$2,868,000**
• Resumed development of optical initiation systems and firing set interface module. • Developed improved safety architectures. • Advanced surety options availability for future weapons systems to meet threshold and objective surety requirements. • Prove-in MPS material in a sub-system architecture for future security needs. • Developed integrated use control and physical security subsystems for U.S. Air Force weapon storage by FY 2022.	• Develop certain surety options for future weapons systems, in accordance with the tri-lab surety roadmap, to meet threshold and objective surety requirements as defined in DOE Order 452.1E. • Establish TRL 5 and MRL 3 for the optical initiation system intended for insertion into the next available warhead. • Continue support the Optical Initiation Technology Realization Team. • Continue to develop advanced safety mechanisms and demonstrate technologies on the next demonstrator. • Continue to develop improved safety architectures that minimize/eliminate issues with inadvertent electrical transmission. • Develop a down-selected set of power management technologies tailored to modernized applications. • Mature to TRL 5 and MRL 3 an all-electrical firing set as a backup to optical initiation technology.	• The decrease reflects a shift of resources to support higher priority NNSA efforts.

Weapon Technology and Manufacturing Maturation
Weapon Technology Development

Description

Weapon Technology Development (WTD) is responsible for developing technology options that are responsive to changing global security environments and for activities that reduce risk and increase the likelihood of insertion of those technologies into the stockpile. The focus of WTD is to improve existing capabilities, provide solutions for addressing capability gaps and shortfalls, evolve capabilities to meet emerging threats and changing policy, and utilize improved technologies and methods to reduce lifecycle costs.

WTD funds activities for the research, development, engineering, integration, and demonstration of technologies that enable the performance, reliability, safety, and responsiveness of current and future stockpile. This includes early-stage development and testing of weapon components targeted to replace sunset technologies and modernize subsystems. This is defined as components facing performance, aging, and/or security issues that can have negative impacts on the performance and safety of a weapon.

Highlights of the FY 2023 Budget

- Develop a distributed bus-based architecture (DBBA) to enable greater component re-use across the stockpile.
- Continue development of field programmable gate arrays and radiation hardened microelectronics used to provide arming, fuzing, firing, other functions within nuclear weapons.
- Mature advanced power source technologies to support future tactical and strategic weapon system LEP insertions, including mature explosive materials, initiation systems, and detonators technologies.
- Develop and improve Neutron Generator (NG) technologies to offset aging effects.
- Continue development efforts for long-life Gas Transfer System (GTS) design options.
- Research and develop next-generation components and materials required to ensure safety, security, reliability, and performance of aging Nuclear Explosive Packages (NEPs).
- Continue efforts with the UK on Joint Technology Demonstrator (JTD) as a strategic collaboration focusing on design and development of new technologies.
- Collaborate with Navy Strategic Systems Programs (SSP) partners and others on future flight opportunities in realistic environments for the Reentry Experiments Development Initiative (REDI).
- Continue support for the Air Force Continuous Demonstrator for Operational Responsiveness (ConDOR) to mature technologies for future Air Force systems.

FY 2024 – FY 2027 Key Milestones

- Development and transition of a modular and adaptable architecture with enhanced capabilities to the next program of record that result in a nuclear stockpile able to respond quickly and easily to changing policy, technology, and threat environments.
- Field Programmable Gate Array (FPGA) fabrication and programming software trust certification completion and achievement of TRL 5. Static Random-Access Memory (SRAM) and Dragonfly processor sample parts available to customers for transition.
- Development and transition of a novel high explosive (HE) formulation with attractive performance characteristics to the next program of record.
- Development and transition of an electronic neutron generator (ELNG) that will provide cost savings in testing and production.
- Investigation and investment in exploratory R&D and technology development options for future Programs of Record.
- Advancement of JTD projects in partnership with the United Kingdom.
- Collaborate with Navy SSP partners and others to field the Reentry Experiments Development Initiative (REDI) flight(s).

FY 2021 Accomplishments

- Fielded and performed Campaign 4 of the HOTSHOT program to demonstrate and mature technologies.
- The joint U.S./UK JTD team completed the Ground Test 2 (GT2) and Ground Test 3B (GT3B) series of experiments demonstrating a new reentry vibration qualification workflow for a subsystem, a full system reentry body in a Mk5-like

envelope, and a modular full-system reentry body. The workflow was demonstrated through combination of modeling and unique multi-axis ground testing that can assess flight environments as well as system and component designs before flight data is available.

- Further developed thermal spray technologies as a potential option for the W87-1 program and other future systems.
- Continued development of key technologies for potential options for the W87-1 including neutron generators, gas transfer system (GTS) components, joint test assembly (JTA) telemetry and firing set capacitors, radiation-hardened high voltage diodes, and sprytrons.
- Made Dragonfly processor sample parts and SRAM available for further testing and development.

Weapon Technology Development
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Weapon Technology Development $131,692,000	**Weapon Technology Development $121,330,000**	**Weapon Technology Development -$10,362,000**
• Development of modular and adaptable architectures with enhanced capabilities that result in a nuclear stockpile able to respond quickly and easily to changing policy, technology, and threat environments. • Integration and development of technologies for the joint U.S. Air Force – NNSA Demonstrator Initiative (ANDI) flights to reduce risks and test insertion options in relevant environments. • Development of long-life GTS design options. • Development and testing of conformal thermal batteries, abnormal launch accelerometers, and replacement inertia sensor technologies. • Development of a new warhead bus architecture and compatible ELNG design for future system insertion to enable reduced cost for future modifications. • Development of field programmable gate arrays, non-volatile memory, and radiation hardened microelectronics used to provide arming, firing, fuzing, and other functions within nuclear weapons. • Development of options for positional aware fuzing. • Executed HOTSHOT sounding rocket flights to mature technologies. • Evaluation of the effectiveness of sounding rockets and other platforms for the qualification of weapon components.	• Continue development of modular and adaptable architectures with enhanced capabilities that result in a nuclear stockpile able to respond quickly and easily to changing policy, technology, and threat environments. • Continue development of a distributed bus-based architecture (DBBA) to enable greater component re-use across the stockpile. • Develop field programmable gate arrays and radiation hardened microelectronics used to provide arming, fuzing, firing, and other functions within nuclear weapons. • Advance development efforts for long-life GTS design options. • Continue research and development of next-generation components and materials required to ensure safety, security, reliability, and performance of aging Nuclear Explosive Packages (NEPs). • Pursue development and testing of advanced thermal batteries, launch accelerometers, and replacement inertial sensor technologies. • Advance an electronic neutron generator (ELNG) for future system insertion to enable reduced costs. Continue development of options for positional aware fuzing. • Maintain efforts with the UK on JTD as a strategic collaboration focusing on design and development of new technologies.	• The decrease reflects a shift of resources to support higher priority NNSA efforts. • The delivery dates for capability enhancements for the future stockpile will be delayed.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
• Development and integration of embedded sensors capability. • Development of major components of an improved firing set architecture for weapon system modernization program insertions. • Evaluations of integrated data instrumentation capabilities for future telemetry systems. • Implementation of NEA and supply chain risk management for R&D activities. • Development and integration of flight-ready payloads on a flight platform to demonstrate and mature technologies. • Continued efforts with the UK on JTD as a strategic collaboration focusing on design and development of new technologies. • Began development of a methodology to reduce the number and duration of design-build-test cycles for technology maturation.	• Pursue further collaboration with Navy Strategic Systems Programs (SSP)partners and others on future flight opportunities in realistic environments for the Reentry Experiments Development Initiative (REDI).	

Weapon Technology and Manufacturing Maturation
Advanced Manufacturing Development

Description

The Advanced Manufacturing Development (AMD) program directly affects the future agility and responsiveness of the National Nuclear Security Administration's (NNSA) manufacturing infrastructure by providing capable, efficient, and effective manufacturing solutions to address technical challenges and replace obsolete processes.

AMD accelerates the development of new manufacturing science and engineering capabilities that will replace hazardous, inefficient, and obsolete processes prior to Phase 6.3 of a modernization program or Phase 3 of a future weapon system. In pursuing the long-term advanced manufacturing strategy, this program prioritizes developing improvements that demonstrate viability for a particular application, which allows future weapon modernization efforts to incorporate those production methods with confidence to meet program requirements, costs, and schedule. Replacing or improving specific processes by Phase 6.3 of a future warhead's Modification Program or Phase 3 or a future weapon system will allow NNSA to reduce future demand on the supply of strategic materials by minimizing efforts needed to recover, recycle, and/or produce the materials, reduce production floor space for certain processes, and manufacture with replacement materials that are less hazardous and costly to produce.

Highlights of the FY 2023 Budget

- Support key manufacturing technologies that are replacing obsolete materials and processes, as well as leverage scientific knowledge for new qualification and verification methods, on a timeline to support delivery of components for future systems.
- Advance qualification and certification methods to use additively manufactured (AM)-produced parts in the active stockpile.
- Transition AM machine capabilities to a production environment to deliver AM parts to the stockpile.
- Conduct testing to confirm components manufactured with new production methods improve performance margins.
- Develop material recyclability processes to reuse scrap material and reduce supply chain risk.
- Leverage advancements in AM topology optimization to enable higher fidelity data and rapid design cycles for current and future system flight tests.
- Advance development of next-generation CMOS8 trusted, strategically radiation-hardened microelectronics manufacturing process technology.
- Develop near net shaping capability of Lithium component forming to increase material efficiency and stretch the available inventory
- Advance technology and manufacturing readiness of Direct Ink Write (DIW) cushions and pads to facilitate Nuclear Security Enterprise-wide divestment from legacy production methods and to meet more challenging system requirements.
- Improve process monitoring capability and automated on-machine metrology of all AM capabilities to reduce time to qualification of current and next-generation components.

FY 2024 – FY 2027 Key Milestones

- Develop and demonstrate various techniques and approaches for cost effective rapid prototyping in support of both basic research and development and stockpile systems programs.
- Advance understanding of additively manufactured components and materials in normal, abnormal, and hostile environments expected for components in the U.S. nuclear arsenal.
- Transition next-generation CMOS8 strategically radiation-hardened microelectronics manufacturing process to the Non-Nuclear Component Program Office and program of record.
- Develop AM thermoset materials that may have advantages in performance, cost, manufacturability, reliability, and/or supply chain security.
- Develop the methodologies required to qualify and certify AM for metal lattices.
- Develop paths to certification and qualification for new components and materials produced via advanced and novel manufacturing techniques.

- Transition improved DIW polymer printing capability to production agencies and upcoming programs of record in order to shift away from conventional processes and reduce floor space requirements by 90%.
- Further develop and demonstrate modern manufacturing methods for high explosives including additive manufacturing and particle injection molding.
- Fully refurbish, enhance, and transition legacy coating capabilities for future systems use

FY 2021 Accomplishments

- Provided the successful demonstration by means of manufacture and characterization of a full-size scale additively manufactured thermoset parts with dimensions and tolerances representative of a mount. Significant gains made in machine automation
- Significantly matured CMOS8 process modules by converting 60% of engineering steps to standard operating codes and hitting all schedule fabrication targets.
- Developed models for use by programs of record to predict contaminants, replace destructive testing, and determine material properties that are impossible, timely, or costly to get; models contribute to significant cost avoidance and potential schedule reduction.
- Matured AM processes for thermal spray, specifically the Controlled Atmospheric Plasma Spray.
- Continued a project execution plan to shift from conventional to AM polymers that by FY 2025 will result in a 90% reduction in polymer production footprint at half the cost per part.
- Used additive manufacturing to fabricate a high explosive (HE) that was transferred to the W87-1 program, leading to reduced costs and manufacturing times.
- Advanced metal AM and lattice technology readiness levels at multiple sites and identified key demonstrators to prove in technology readiness
- Developed and tested additively manufactured HE with improved safety margins over conventional HE and better performance than insensitive HE.
- Completed legacy components/material property survey and created target properties and functional requirements table for AM thermosets and thermoplastics. Identified first technology and risk reduction opportunities. Advanced ability to print strong materials at scale and in complexity.
- All design agencies showed ability to shape HE breakout profiles through novel AM methods. New modeling techniques predicted accuracy of wave shape to nanosecond precision.
- New thermoset AM processes and design optimization tools were shown to provide designers with new degrees of freedom to optimize structures for shearing stresses and properties at ground level.
- Completed all technology maturation deliverables for Direct Cast, achieved TRL 6 and MRL 4, and transitioned technology to the Secondary Stage Production Modernization Program Office .
- Released at-risk materials in the GRANTA Weapons Materials Specifications Database for cross-site sharing on the Enterprise Secure Network.
- Utilized a toluene-free amination high explosive precursor material that reduces environmental hazards and improves batch throughput over 50% for new, safer high explosive formulations.
- Demonstrated the ability to design and synthesize MgO materials with similar nanoscale structure to dwindling magic barrel materials and demonstrated their function in prototype batteries.
- Successfully produced a low density additively manufactured mock HE formulation for use in upcoming joint test assemblies (JTAs), which has the potential to greatly reduce cost, prevent scheduling delays, and increase worker safety
- Demonstrated high density injection molding of mock and stood up injection molding incubator facility and New Mexico Tech.

Advanced Manufacturing Development
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Advanced Manufacturing Development $111,908,000	**Advanced Manufacturing Development $113,338,000**	**Advanced Manufacturing Development +$1,430,000**
• Continued work in Design for Manufacturing. • Continued to develop certification and qualification methods to widen the use of AM-produced parts in the active stockpile. • Incorporated next-generation digital manufacturing methods through use of computational simulations and model-based designs. • Implemented new strategically radiation-hardened microelectronics production capabilities to enable new systems architectures. • Developed new energetic materials formulations that are safer to produce and replace legacy materials that are no longer commercially available. • Increased technology development for use of laser powder bed fusion technology to demonstrate the potential to supplement production capabilities for near term programs of record. • Developed additively manufactured thermoset materials that have advantages in performance, cost, manufacturability, reliability, and supply chain security. • Developed methodologies required to qualify and certify AM for metal lattices. • Developed methodologies required to design and certify AM for printed electronics.	• Advance certification and qualification methods, like integrated computational materials engineering and in-situ diagnostics, to widen the use of AM-produced parts in the active stockpile. • Further mature AM Pads and Cushions capability and facilitate the technology transfer between LLNL, LANL, and KCNSC. • Improve confidence in next-generation digital manufacturing methods through use of computational simulations and model-based designs. • Advance manufacturing readiness level of new strategically radiation-hardened microelectronics production capabilities to enable new systems architectures and mature interconnect technologies for heterogeneous integration. • Continue development of new energetic materials formulations that are safer to produce and replace legacy materials that are no longer commercially available. • Improve upon spatial tolerances, residual stress reduction, and qualification of laser powder bed fusion technology to demonstrate the potential to supplement production capabilities for near term programs of record. • Complete and down-selected a methodology for inspecting and certifying AM for metal lattices.	• The increase reflects additional development of manufacturing capabilities for future weapons systems.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
• Developed AM processes for stochastic coatings. • Developed testing of advanced methods for high explosives manufacture with improved safety margins over conventional HE and better performance than insensitive HE. • Leveraged polymer and metal AM topology optimization to improve high fidelity mechanical mock flight tests for current and future systems.	• Continue development of AM for printed electronics and identify new insertion opportunities. • Advance development of AM processes for thermal spray coatings. • Continue to develop testing of advanced methods for high explosives manufacture with improved safety margins over conventional HE and better performance than insensitive HE. • Continue process scaleup of additively manufactured and injection molded HE and mock. • Develop material recycling processes to create feedstock for AM. • Leverage embedded sensors to study long-term aging effects of AM materials and components. • Continue development of polymer and metal AM topology optimization to improve high fidelity mechanical mock flight tests and further tailor to future system requirements. • Advance development of next-generation CMOS8 trusted, strategically radiation-hardened microelectronics manufacturing process technology. • Develop near net shaping capability of Lithium component forming to increase material efficiency and stretch the available inventory.	

Stockpile Research, Technology, and Engineering
Academic Programs

Overview
The challenges of modernizing our nuclear stockpile demand a strong and diverse base of national expertise and educational opportunities in specialized technical areas that uniquely contribute to nuclear stockpile stewardship. Academic Programs within SRT&E is designed to support investments in science and engineering disciplines of critical importance to NNSA's nuclear security enterprise. This includes such disciplines as nuclear science, radiochemistry, materials at extreme conditions, high energy density science, advanced manufacturing, and high-performance computing. The program's grants, centers, fellowships, and other funding options offer an introduction to the mission and people in the national laboratories, establishing a workforce pipeline to strengthen the future enterprise. Academic Programs has three goals:

1. Develop the next generation of diverse, highly trained technical workers able to support NNSA's core missions.
2. Maintain technical expertise external to the nuclear security enterprise for providing valuable oversight, cross-check, and peer review.
3. Enable innovation to enhance nuclear security enterprise missions to strengthen key fields of research relevant to the NNSA mission.

Academic Programs enables robust and diverse science, technology, engineering, and mathematics (STEM), and research for educational communities through a variety of methods of support. Investments in consortia and centers of excellence provide collaborative groups to tackle large questions through multi-disciplinary approaches, and they leverage preeminent scientists in relevant fields. Research grants and focused investigatory centers support individual principal investigators to foster a vibrant community that is responsive to new breakthroughs by providing flexibility for new ideas, diversity, and career growth. Specific support to minority and tribal-serving institutions prepares a diverse workforce of world-class talent through strategic partnerships. Fellowships provide graduate students with key opportunities to connect with the NNSA missions and provide direct experiences at nuclear security enterprise sites. User facilities open opportunities for academic partners to use NNSA's cutting-edge research facilities and push frontiers of current scientific understanding. All Academic Programs focus on quality science through competitive award, connection with NNSA mission work at national security laboratories and nuclear weapons production facilities, and a view to the nuclear security enterprise's future needs and opportunities.

Primary responsibilities of this program include:
- Managing academic solicitations and competitive awards.
- Providing vibrant technical expertise aligned with the nuclear security enterprise's current and future needs.
- Enabling connections between academic research communities and the nuclear security enterprise to foster understanding of the NNSA mission.
- Attracting and training a future workforce through on-site opportunities and personal connections with laboratory scientists and engineers.

Academic Programs was established in FY 2021 to bring together similar activities across the SRT&E programs. By combining these activities, NNSA will gain coordination across programs and leverage strengths and integrate resources to address the needs of NNSA interactions with academic partners.

The Academic Programs is made up of five subprograms:
1. Stewardship Science Academic Alliance (SSAA)
2. Minority Serving Institution Partnership program (MSIPP), including the Tribal Education Partnership program (TEPP)
3. Joint Program in High Energy Density Laboratory Plasmas (JPHEDLP)
4. Computational Science Graduate Fellowship (CSGF)
5. Predictive Science Academic Alliance program (PSAAP)

Academic Programs
Stewardship Science Academic Alliance

Description

The SSAA subprogram supports scientific academic research programs to develop the next generation of highly trained technical workers able to support its core mission and to ensure there is a strong community of technical peers, external to the NNSA national laboratories, capable of providing peer review and scientific competition to strengthen the basic fields of research relevant to NNSA's nuclear security enterprise.

The SSAA subprogram funds both collaborative centers of excellence and smaller individual investigator research projects to conduct fundamental science and technology research of relevance to stockpile stewardship. Current technical areas include studies of materials under extreme conditions, low-energy nuclear science, high-energy-density physics, and radiochemistry. SSAA funding supports research at approximately 80 universities, including training of over 200 graduate students and post-doctoral researchers. A key element of both centers of excellence and individual investigator awards is the connection of students with the nuclear security enterprise. These opportunities are focused on technical fields critical to stewardship science, building a field of talented researchers and committed doctoral students sharing a common desire to advance science while contributing to national security.

The SSAA subprogram also funds the Stewardship Science Graduate Fellowship (SSGF) and the Laboratory Residency Graduate Fellowship (LRGF) with the goal of addressing workforce needs by providing financial support and professional development opportunities to students pursuing a Ph.D. in fields of study that address complex science and engineering problems critical to stockpile stewardship.

Highlights of the FY 2023 Budget

- Supports funding opportunity announcement for SSAA university research grants to solicit scientific research in areas crucial to the Stockpile Stewardship Program.
- Provide fourth year of support for ongoing SSAA centers of excellence and complete on-site mid-term progress review.
- Continue to provide support and hands-on training for graduate students in areas relevant to stockpile stewardship, connecting these students with opportunities at the National Laboratories, by placing a new annual cohort of fellows as part of the SSGF and LRGF graduate fellowship programs.
- Sponsor the annual SSAA symposium bringing together research teams supported by the SSAA, the JPHEDLP, and the National Laser User Facility (NLUF) programs. In addition to highlighting current research and encouraging collaboration, a focus on students includes activities such as poster competitions, student lunch with lab representatives, and "lab hour" highlighting lab directions and opportunities for students/graduates.

FY 2024 – FY 2027 Key Milestones

- Support cohort of individual investigator grants in fields of nuclear science, radiochemistry, and materials at extreme conditions to develop the next generation of highly trained technical staff.
- New Funding Opportunity Announcement for the next cohort of centers of excellence expected to be released in Q2 FY 2022, to be awarded on FY 2024 funds (joint with HEDLP).
- Support full cohorts of SSGF and LRGF fellows.

FY 2021 Accomplishments

- Established new Center researching materials at extreme conditions, awarded in July 2020 from a competitive funding opportunity announcement for SSAA centers of excellence.
- Awarded a five-year contract that began September 1, 2020, for continued management of the SSGF and LRGF Fellowships through a competitive solicitation.

Stewardship Science Academic Alliance
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Stewardship Science Academic Alliance $31,212,000	**Stewardship Science Academic Alliance $24,220,000**	**Stewardship Science Academic Alliance -$6,992,000**
• Supported the SSAA Program to develop the next generation of highly-trained technical workers able to support the NNSA core mission and to ensure there is a strong community of technical peers. • Supported Stewardship Science Graduate Fellowship (SSGF) and Laboratory Residency Graduate Fellowship (LRGF) programs, the fourth year of LRGF will bring the total LRGF fellows to the projected stable level of 16. • Started the National Laboratory Jobs ACCESS program per Congressional direction.	• Support scientific research in areas crucial to the stockpile stewardship program. • Support fourth year of SSAA centers of excellence. • Continue to provide support and hands on training for graduate students in areas relevant to stockpile stewardship, through fellowship programs. • Sponsor highly attended annual SSAA symposium bringing together research teams supported by the SSAA, the JPHEDLP, and the National Laser User Facility (NLUF) programs.	• The decrease reflects additional funding provided in the FY 2022 appropriation that will be executed over a two-year period.

Academic Programs
Minority Serving Institution Partnership Program

Description

NNSA Minority Serving Institution Partnership Program (MSIPP)'s mission is to create and foster a sustainable STEM-pipeline that prepares a diverse workforce of world class talent through strategic partnerships between Minority-Serving Institutions and the NNSA nuclear security enterprise. MSIPP has direct alignment to the Executive Order on "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government" through its support to Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs). MSIPP aligns investments in university capacity and workforce development with the NNSA mission to develop the needed skills and talent for the nuclear security enterprise's enduring technical workforce and to enhance research and education capacity at under-represented colleges and universities.

This alignment is defined by the following goals:

(1) Strengthen and expand minority- and tribal-serving institutions' educational and/or research capacity in NNSA mission areas of interest.
(2) Target collaborations between minority- and tribal-serving institutions and the nuclear security enterprise that increase interactions to provide minority- and tribal-serving institutions' direct access to nuclear security enterprise resources.
(3) Increase the number of MSI students who graduate with STEM degrees relevant to NNSA mission areas and who have had exposure to career opportunities within the nuclear security enterprise.
(4) Increase the number of minority graduates and post-doctoral students hired into the nuclear security enterprise's technical and scientific workforce.

Highlights of the FY 2023 Budget

- Pursue consortium-based STEM grants that specifically target HBCUs, HSIs and TCUs and provide them the opportunity to build their STEM capacity and academic infrastructure with alignment to the nuclear security enterprise.
- Increase student engagement and internship opportunities and confirm the hiring of various minority students into the nuclear security enterprise that have matriculated through various STEM consortium pipelines.
- Continue existing partnerships with Minority-Serving Institutions.
- Support the MSIPP consortium-based model focused on capacity building, research, student education programs and internships in STEM.
- Supports building educational/institutional infrastructure and enhancing the pipeline of diverse, high-quality talent in STEM academic disciplines and careers.

FY 2024 – FY 2027 Key Milestones

- Develop and maintain a long-term, recruiting pipelines to NNSA laboratories, plants, and sites by increasing awareness of MSIPP and increasing partnerships between MSIs and the NSE.
- Partner with other federal agencies and/or programs to broaden the reach of the MSIPP with a goal of pursuing mission related STEM projects of mutual interest that will further enhance the educational and/or research capacity at MSIs.
- Grow the number of Tribal Colleges/University partners participating in MSIPP to build their capacity and academic infrastructure in STEM and increase awareness of opportunities available within the NSE.

FY 2021 Accomplishments

- Conducted third competitive solicitation for consortium-based STEM grants. Eleven new grants were awarded for strategic partnerships between MSIs and the nuclear security enterprise, which includes representation from HBCUs, HSIs, and TCUs.
- Awarded eight continuation applications.
- Released first Funding Opportunity Announcement for the Tribal Education Partnership Program resulting in two new grants being awarded.

Minority Serving Institution Partnership
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Minority Serving Institution Partnership $35,000,000	**Minority Serving Institution Partnership $40,000,000**	**Minority Serving Institution Partnership +$5,000,000**
• Continued existing partnerships with Minority Serving Institutions. • Supported the MSIPP consortium-based model focused on capacity building, research, student education programs and internships in STEM. • Supported building educational/institutional infrastructure and enhancing the pipeline of diverse, high-quality talent in STEM academic disciplines and careers.	• Continue existing partnerships with Minority Serving Institutions. • Continue consortium-based STEM grants that specifically target HBCUs, HSIs, and TCUs and provide them the opportunity to build their STEM capacity and academic infrastructure with alignment to the nuclear security enterprise. • Increase student engagement and internship opportunities and confirm the hiring of various minority students into the nuclear security enterprise that have matriculated through various STEM consortium pipelines.	• The increase includes continued support to existing partnerships until award completion and continuing to build capacity at partner institutions.
Tribal Education Partnership Program (TEPP) $5,000,000	*Tribal Education Partnership program (TEPP) $5,000,000*	*Tribal Education Partnership program (TEPP) $0*
• Continued existing partnerships with TCUs. • Supported the building educational/institutional infrastructure and enhancing the pipeline of diverse, high-quality talent in STEM academic disciplines and careers.	• Maintain partnerships with TCUs. • Maintain educational/institutional infrastructure and enhancing the pipeline of diverse, high-quality talent in STEM academic disciplines and careers.	• No change.

Academic Programs
Joint Program in High Energy Density Laboratory Plasmas

Description

High energy density (HED) states are central to many aspects of nuclear weapons. Maintaining a strong HED academic community in this unique field will be critical for future needs of a modern nuclear stockpile. The JPHEDLP is designed to steward the study of laboratory HED plasma physics by funding academic research of ionized matter in laboratory experiments where the stored energy reaches approximately 100 billion joules per cubic meter (i.e., pressures of approximately 1 million atmospheres). The program has three primary elements: individual investigator research grants, research centers of excellence, and facility access.

Individual investigator grants: NNSA's Office of Experimental Sciences partners with the DOE's Office of Fusion Energy Sciences in the Office of Science to issue an annual joint solicitation for HED Laboratory Plasmas research. The coordination across agencies enables the support of a strong and broad academic presence in HED science, leveraging common interests while assuring NNSA specific interests in this area remain vibrant. Competitively awarded research grants are selected through the joint solicitation conducted in coordination with the Office of Science.

Research Centers of Excellence: The Joint Program in HEDLP funding also supports the HED centers of excellence selected under the competitive SSAA process. Centers of Excellence are an integrated multi-institutional collaborative effort focused on a central problem or theme. These centers work closely with nuclear security enterprise scientists and maintain a core set of academic expertise in key technical areas.

Facility access: Support broad scientific facility access to apply NNSA unique tools to accomplish cutting-edge science. Hands-on research experience to academic and industrial researchers using the Omega and Omega EP lasers as tools for conducting basic research experiments. In the pursuit of fundamental science advances, the innovative development of diagnostics and platforms by user facility partners have often proven to benefit NNSA experimental needs.

Community development: Specialized educational opportunities both train and attract students HED science. The HEDLP program provides funding for HED summer schools and facility workshops. Beginning in FY 2023, to broaden and diversify participation, the HEDLP program will offer grant supplements for added undergraduate participation and inclusion of graduate students of underrepresented groups.

Highlights of the FY 2023 Budget

- Expand opportunities for national collaboration in high energy density science research through the enhancement of existing grants and cooperative agreements as well as the establishment of new financial assistance awards.
- Support academic research Centers of Excellence in HED science.
- Award academic research grants in HEDLP competitively awarded through annual HEDLP funding opportunity announcement (FOA) held jointly with the DOE-Office of Science, annual selection of NNSA supported awards will enhance flexibility, attract new researchers, and assure career opportunities.
- Support facility access and community development through facility-time travel support, HED summer schools, facility user workshops.

FY 2024 – FY 2027 Key Milestones

- Support cohorts of HEDLP grants to enable a strong and broad academic presence in HED science.
- Continue collaborating with DOE-SC on next annual joint solicitation for HED Laboratory Plasmas research.
- Release new Funding Opportunity Announcement for the next cohort of HED Centers of Excellence in Q3 FY 2022, to be awarded on FY 2024 funds (joint with SSAA).
- Assess success of new supplemental grant program and adjust effort for maximum DEI and undergraduate benefit.

FY 2021 Accomplishments

- Executed a solicitation for new research grants, jointly managed with the Office of Science's Fusion Energy Science.

- Established a MOU between the National Science Foundation (NSF) and NNSA for collaboration on the advancement of HED science.
- Delivered a total of 1,825 target shots on Omega (including Omega EP), 877 for LLE and 948 for non-LLE facility users.
- Delivered world-leading scientific discoveries, published in preeminent scientific journals and media outlets.

Joint Program in High Energy Density Laboratory Plasmas
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Joint Program in High Energy Density Laboratory Plasmas $8,700,000	**Joint Program in High Energy Density Laboratory Plasmas $8,883,000**	**Joint Program in High Energy Density Laboratory Plasmas +$183,000**
• Supported academic grants and cooperative agreements, including support for several research Centers of Excellence in high energy density (HED) science.	• Expand opportunities for national collaboration in HED science research through the enhancement of existing grants and cooperative agreements as well as the establishment of new financial assistance awards. • Support academic research Centers of Excellence in HED science. • Support academic research grants in HEDLP competitively awarded through annual HEDLP funding opportunity announcement held jointly with the DOE Office of Science. • Offer supplemental grants to increase diversity among participants. • Continue to support facility access and community development through HED summer schools and facility user workshops.	• The increase continues to support JHEDLP's expansion of opportunities for national collaboration in HED science research.

Academic Programs
Computational Science Graduate Fellowship

Description

The goal of the DOE Computational Science Graduate Fellowship (CSGF) program is to cultivate the next generation of scientists and engineers in computational sciences. For NNSA, CSGF supports the ASC and Stockpile Modernization missions by establishing academic programs for multidisciplinary simulation science and through graduate fellowships providing students the relevant experience for weapons code development through open science applications. The NNSA CSGF activity is managed by the Krell Institute and jointly funded with the DOE Office of Science's Advanced Scientific Computing Research program.

The DOE CSGF fosters a community of enthusiastic and committed doctoral students, alumni, DOE laboratory staff and various scientists who desire to have an impact on national security and energy missions while advancing their research. It increases collaboration between NNSA national security laboratories, the fellows, and their universities by enhancing the fellows' research experience at the National Laboratories via access to unclassified high-performance computing systems and exposing them to the broader, multi-disciplinary research activities at the laboratories. The program also provides a yearly stipend, tuition fee coverage, and academic allowance.

Highlights of the FY 2023 Budget

- Collaborate with DOE Office of Science in funding new cohort of fellows to be trained as next-generation leaders in computational science.
- Foster a CSGF community of energetic and committed doctoral students, alumni, and DOE/NNSA laboratory staff who all together serve as a support system for the new and current fellows.
- Continue NNSA commitment for CSGF to support resources for ensuring a supply of scientists and engineers trained to meet NNSA workforce needs in computational science.

FY 2024 – FY 2027 Key Milestones

- Support the next cohorts of fellows in the CSGF Program.
- Enhance visibility for computational science careers by supporting CSGF program to ensure a pipeline of trained scientists and engineers to meet DOE/NNSA workforce needs in computational science.
- Continue to strengthen ties between the national academic community and DOE/NNSA laboratories so the fellowship's multidisciplinary nature builds the national scientific community.

FY 2021 Accomplishments

- Selected a record level of new cohort of fellows and provided benefits in STEM fields that use high performance computing to solve complex science and engineering problems.
- Held a successful annual CSGF Program Review that highlighted incoming and ongoing CSGF fellows' research work performed during the year.
- Funded NNSA commitment for CSGF to help ensure a supply of scientists and engineers trained to meet NNSA workforce needs in computational science.

Computational Science Graduate Fellowship
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Computational Science Graduate Fellowship $2,000,000	**Computational Science Graduate Fellowship $2,000,000**	**Computational Science Graduate Fellowship $0**
• Supported a new cohort of fellows. • Funded NNSA commitment for CSGF to help ensure a pipeline of trained scientists and engineers to meet NNSA workforce needs in computational science.	• Collaborate with DOE Office of Science in funding new cohort of fellows to be trained as next-generation leaders in computational science. • Support CSGF community of energetic and committed doctoral students, alumni, and DOE/NNSA laboratory staff who all together serve as a support system for the new and current fellows. • Continue support for enhancing number of scientists and engineers trained to meet NNSA workforce needs in computational science.	• No change.

Academic Programs
Predictive Science Academic Alliance Program

Description

The Predictive Science Academic Alliance Program (PSAAP) engages with leading U.S. universities, focusing on the development and demonstration of technologies and methodologies to solve open science and engineering application problems. The research performed by the universities in this program is discipline-focused to further predictive science and enabled by effective use of high-performance computing. Predictive science is the aim of this program and is based on verification and validation and uncertainty quantification methodologies for large-scale simulations.

PSAAP consists of the following types of centers: Multi-disciplinary Simulation Centers (MSCs), Single-Discipline Centers (SDCs), and Focused Investigatory Centers (FICs). MSCs focus on scalable application simulations, targeting large-scale, integrated multidisciplinary problems, while SDCs focus on scalable application simulation for targeting a broad single science or engineering discipline. FICs are tightly focused on a specific research topic of interest to NNSA's mission, in either a science/engineering discipline or an exascale-enabling technology.

PSAAP has a long-term goal to cultivate the next generation of scientists and engineers to support the ASC and DSW missions. The funded PSAAP Centers will help their institutions develop new academic programs, or strengthen existing efforts, for multidisciplinary, computational science and engineering research, while providing students and research staff very relevant code development and HPC experience through open science and engineering applications.

Highlights of the FY 2023 Budget

- Continue to support large-scale, multi-disciplinary, predictive science, simulation-based research as a major academic applied research program.
- Manage PSAAP III Academic Alliance Centers in their third project year to achieve annual milestone objectives.
- Administer dedicated, appropriate ASC computing resources and user support to enable the PSAAP Centers to achieve their respective simulation demonstration milestones regarding their overarching research objectives.

FY 2024 – FY 2027 Key Milestones

- Continue engagement and support for the PSAAP III Centers into their fourth and fifth years of their respective cooperative agreements.
- Support continued development and demonstration of technologies and methodologies to support effective exascale computing in the context of science/engineering applications.
- Conduct annual and closeout reviews for each of the PSAAP III Centers.
- Review subject areas and disciplines relevant to NNSA mission needs prior to start of PSAAP IV phase.
- Execute plan for PSAAP IV procurement by preparing the Request for Information (RFI) and Funding Opportunity Announcement (FOA) solicitations.

FY 2021 Accomplishments

- Engaged with PSAAP III Centers on technical topics and staff recruitment.
- Completed Trilab Sponsor Team (TST) reviews for the PSAAP III Centers and provided recommendations for ongoing research efforts on the respective projects.
- Conducted annual reviews for each PSAAP III Center to ensure progress for various milestones and NNSA lab interactions with the universities.
- Provided dedicated, appropriate ASC computing resources and user support to enable the PSAAP III Centers to achieve their annual simulation demonstration milestones.
- Promoted collaborations with universities involving training, recruiting, and working with top researchers in key disciplines through internship experiences with the NNSA laboratories.

Predictive Science Academic Alliance Program
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Predictive Science Academic Alliance Program $20,000,000	**Predictive Science Academic Alliance Program $20,396,000**	**Predictive Science Academic Alliance Program +$396,000**
• Supported the new PSAAP III centers in their first year to work on proposed research objectives relevant to NNSA missions. • Provided dedicated, appropriate ASC computing resources and user support to enable the PSAAP Centers to achieve their annual simulation demonstration milestones. • Promoted collaborations with universities involving training, recruiting, and working with top researchers in key disciplines required by stockpile stewardship. • Engaged with U.S. academic community in making significant advances in predictive modeling and simulation technologies. • Coordinated among academic programs to continue to foster more development in addressing objectives and collaboration among the cohort.	• Continue development and demonstration of technologies and methodologies to support effective exascale computing in the context of science/engineering applications. • Support PSAAP III Academic Alliance Centers in their third project year to achieve annual milestone objectives. • Provide appropriate ASC high performance computing resources and user support for the PSAAP Centers to accomplish the requisite simulation demonstration milestones.	• Increase supports PSAAP III Academic Alliance Centers in developing and demonstrating integrated predictive simulations and scientific advances in exascale computing.

Stockpile Research, Technology, and Engineering
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	418,276	455,965	534,137	+115,861
Minor Construction	N/A	N/A	56,633	24,515	19,904	-36,729
Total, Capital Operating Expenses	**N/A**	**N/A**	**474,909**	**480,481**	**554,041**	**+79,132**
Capital Equipment > $500K (including MIE)						
Total Non-MIE Capital Equipment (>$500K and <$5M)	N/A	N/A	94,374	96,450	98,572	+4,198
NIF High Resolution, neutron-hardened VISAR, LLNL	7,230	1,150	550	5,530	0	-550
Sierra (ATS-2) System, LLNL	170,500	168,300	2,200	0	0	-2,200
NIF Master Oscillator Recapitalization, LLNL	10,900	1,500	9,400	0	0	-9,400
Time-resolved Material Diffraction Diagnostics on NIF, LLNL	5,300	0	0	5,300	0	0
Subnanosecond laser replacement, LLNL	8,000	0	0	8,000	0	0
Commodity Technology System (CTS) 2, LLNL (previously CTS-2)[a]	70,000	0	0	10,000	20,000	+20,000
El Capitan (ATS-4), LLNL	600,000	79,000	100,000	125,000	110,000	+10,000
Target Alignment Sensor Upgrade, LLNL	11,000	0	0	0	11,000	+11,000
Unclassified El Capitan-like System (ATS-4), LLNL	19,700	0	0	0	200	+200
Neutron Imaging System - Polar (previously NIS Equator 90-213), LLNL	6,700	0	0	0	6,700	+6,700
Cryogenic Magnetized Targets, LLNL	12,000	0	0	2,000	10,000	+10,000
Target LRU, LLNL	6,900	0	0	0	0	0
Energy upgrade to OTS Laser, LLNL	6,000	0	0	0	0	0
Time Resolved Magnetic Recoil Spectrometer, LLNL	6,000	0	0	0	0	0
Polar Diagnostic Instrument Manipulator Replacement, LLNL	19,400	0	0	0	0	0
Final Optic Damage Inspection System Replacement, LLNL	12,200	0	0	0	0	0

[a] Each year a useful system (asset) is purchased.

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
3w Power Sensors, LLNL	19,600	0	0	0	4,700	+4,700
NIF Sustainment, LLNL	100,300	0	0	0	6,900	+6,900
Advanced Sources and Detector, LANL	1,284,161	225,055	166,752	174,685	247,065	+80,313
Crossroads (ATS-3) System, LANL	127,000	48,000	45,000	14,000	8,000	-37,000
LANSCE Modernization Project (LAMP), LANL	500,000	0	0	0	0	+0
ATS-5 System, LANL	250,000	0	0	0	0	0
U1a Optical Velocimetry Diagnostics, NNSS	10,000	0	0	10,000	0	+0
Commodity Technology System (CTS) 2, SNL[a]	20,000	0	0	5,000	5,000	+5,000
ATS-Application Regression Testbed (ART) System - El Capitan, SNL	6,000	0	0	0	6,000	+6,000
ATS-Application Regression Testbed (ART) System - Crossroads, SNL	6,000	0	0	0	0	0
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**418,276**	**455,965**	**534,137**	**+115,861**

[a] Each year a useful system (asset) is purchased.

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Minor Construction Projects (Total Estimated Cost (TEC)						
Total Minor Construction Projects (TEC <$5M)	N/A	N/A	12,833	13,115	13,404	+571
SCC Electrical Upgrades, LANL	18,400	0	18,400	0	0	-18,400
ATS-5 Cooling Installation, LANL	18,000	0	0	0	0	0
ATS-5 Electrical Installation, LANL	12,000	0	0	0	0	0
Crossroads Installation Project, LANL[a]	18,759	663	10,569	5,710	1,817	-8,752
B654 Low Conductivity Water (LCW) Installation, LLNL	5,000	4,000	1,000	0	0	-1,000
B453 El Capitan Site Infrastructure, LLNL	18,000	0	18,000	0	0	-18,000
Bldg 453 CTS Power and Cooling Improvements/Modifications, LLNL	7,000	0	0	0	0	0
Bldg 451 Power and Cooling Improvements/Modifications, LLNL	7,500	0	0	0	0	0
U1a.03 Test Bed Facility Improvements, NNSS	17,200	5,200	6,400	5,600	0	-6,400
4MW Power Upgrade for 725 HPC Facility, SNL	5,500	0	0	5,500	0	0
Infrastructure Platform, SNL	6,800	0	0	300	6,500	+6,500
Cooling Capacity Expansion, SNL	9,500	0	0	0	0	0
Total, Minor Construction Projects	**N/A**	**N/A**	**67,202**	**30,225**	**21,721**	**-45,481**
Total, Capital Summary	**N/A**	**N/A**	**485,478**	**486,191**	**555,858**	**+70,380**

[a] Crossroads Installation Project construction work was incorrectly included in the MIE and was not properly notified.

Outyears Capital Summary

	(Dollars in Thousands)				
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))					
Capital Equipment >$500K (including MIE)	669,141	565,761	309,122	261,437	N/A
Minor Construction	24,949	33,750	52,308	14,623	N/A
Total, Capital Operating Expenses	**694,089**	**599,511**	**361,430**	**276,060**	**N/A**
Capital Equipment > $500K (including MIE)					
Total Non-MIE Capital Equipment (>$500K and <$5M)	100,741	102,957	105,222	107,537	N/A
Commodity Technology System (CTS) 2, LLNL	20,000	20,000	0	0	0
El Capitan (ATS-4), LLNL	110,000	76,000	0	0	0
Unclassified ATS-4-like System, LLNL	3,900	3,900	3,900	3,900	3,900
Target LRU, LLNL	6,900	0	0	0	0
Energy upgrade to OTS Laser, LLNL	6,000	0	0	0	0
Time Resolved Magnetic Recoil Spectrometer, LLNL	6,000	0	0	0	0
Polar Diagnostic Instrument Manipulator Replacement, LLNL	0	19,400	0	0	0
Final Optic Damage Inspection System Replacement, LLNL	12,200	0	0	0	0
3w Power Sensors, LLNL	14,900	0	0	0	0
NIF Sustainment, LLNL	21,200	72,200	0	0	0
Advanced Sources and Detector, LANL	250,300	150,304	70,000	0	0
Crossroads (ATS-3) System, LANL	6,000	6,000	0	0	0
LANSCE Modernization Project (LAMP), LANL	100,000	100,000	100,000	100,000	100,000
ATS-5 System, LANL	0	10,000	30,000	50,000	160,000
Commodity Technology System (CTS) 2, SNL	5,000	5,000	0	0	0
ATS-Application Regression Testbed (ART) System - Crossroads, SNL	6,000	0	0	0	0
Total, Capital Equipment (including MIE)	**669,141**	**565,761**	**309,122**	**261,437**	**N/A**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
	(Dollars in Thousands)				
Minor Construction Projects (Total Estimated Cost (TEC)					
Total Minor Construction Projects (TEC <$5M)	13,699	14,000	14,308	14,623	N/A
ATS-5 Cooling Installation, LANL	0	500	17,500	0	0
ATS-5 Electrical Installation, LANL	0	500	11,500	0	0
Bldg 453 CTS Power and Cooling Improvements/Modifications, LLNL	700	6,300	0	0	0
Bldg 451 Power and Cooling Improvements/Modifications, LLNL	750	6,750	0	0	0
Cooling Capacity Expansion, SNL	9,500	0	0	0	0
Total, Minor Construction Projects	**24,649**	**28,050**	**43,308**	**14,623**	**N/A**
Total, Capital Summary	**693,789**	**593,811**	**352,430**	**276,060**	**N/A**

Stockpile Research, Technology, and Engineering
Construction Project Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request
Stockpile Research, Technology, and Engineering					
25-D-XXX, Combined Radiation Effects Survivability Testing, SNL					
TEC	1,551,000	0	0	0	0
OPC	551,000	1,000	5,000	5,000	33,000
TPC, 25-D-XXX, Combined Radiation Effects Survivability Testing, SNL	**2,102,000**	**1,000**	**5,000**	**5,000**	**33,000**
18-D-620, Exascale Computing Facility Modernization Project, LLNL					
TEC	105,200	76,000	29,200	0	0
OPC	6,000	4,000	1,000	1,000	0
TPC, 18-D-620, Exascale Computing Facility Modernization Project, LLNL	**111,200**	**80,000**	**30,200**	**1,000**	**0**
17-D-640, U1a Complex Enhancements Project (UCEP), NNSS					
TEC	567,200	88,600	160,600	135,000	53,130
OPC[a]	9,672	6,309	0	410	0
TPC, 17-D-640, U1a Complex Enhancements Project (UCEP), NNSS	**576,872**	**94,909**	**160,600**	**135,410**	**53,130**
Total, Stockpile Research, Technology, and Engineering					
TEC	**2,223,400**	**164,600**	**189,800**	**135,000**	**53,130**
OPC	**566,672**	**11,309**	**6,000**	**6,410**	**33,000**
TPC Total, Stockpile Research, Technology, and Engineering	**2,790,072**	**175,909**	**195,800**	**141,410**	**86,130**

[a] U1a Complex Enhancements Project OPCs are funded under Enhanced Capabilities for Subcritical Experiments within the Assessment Science Program.

Outyears Construction Project Summary

	(Dollars in Thousands)				
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
Stockpile Research, Technology, and Engineering					
25-D-XXX, Combined Radiation Effects Survivability Testing, SNL					
TEC	0	97,000	164,000	212,000	1,078,000
OPC	30,000	6,000	6,000	6,000	459,000
TPC, 25-D-XXX, Combined Radiation Effects Survivability Testing, SNL	**30,000**	**103,000**	**170,000**	**218,000**	**1,537,000**
18-D-620, Exascale Computing Facility Modernization Project, LLNL					
TEC	0	0	0	0	0
OPC	0	0	0	0	0
TPC, 18-D-620, Exascale Computing Facility Modernization Project, LLNL	**0**	**0**	**0**	**0**	**0**
17-D-640, U1a Complex Enhancements Project (UCEP), NNSS					
TEC	129,870	0	0	0	0
OPC	0	2,953	0	0	0
TPC, 17-D-640, U1a Complex Enhancements Project (UCEP), NNSS	**129,870**	**2,953**	**0**	**0**	**0**
Total, Stockpile Research, Technology, and Engineering					
TEC	**129,870**	**97,000**	**164,000**	**212,000**	**1,078,000**
OPC	**30,000**	**8,953**	**6,000**	**6,000**	**459,000**
TPC Total, Stockpile Research, Technology, and Engineering	**159,870**	**105,953**	**170,000**	**218,000**	**1,537,000**

17-D-640, U1a Complex Enhancements Project (UCEP)
Nevada National Security Site (NNSS), Mercury, Nevada
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the U1a Complex Enhancements Project (UCEP) is $53,130,000. The Project Management Executive reaffirmed CD-1 for Subproject 17-D-640-020 Laboratory and Support Infrastructure on February 25, 2021, following cost growth in the project above DOE O 413.3B thresholds.

The most recent approved Critical Decision (CD) for UCEP was CD-3B for Subproject 17-D-640-020, *Enhanced Capabilities for Subcritical Experiments (ECSE) Laboratory and Support Infrastructure*, approved on August 30, 2021. The design of Subproject 17-D-640-020 continues to mature as the requirements (power, cooling, etc.) are fully defined. The Total Project Cost (TPC) range is $455,000,000 to $576,502,000, and the high end of the range for CD-4, *Approve Start of Operations or Project Completion*, is the first quarter of FY 2027.

Subproject 17-D-640-010 *ECSE Access and Life Safety infrastructure* was baselined on March 27, 2019 with a Class 1 estimate. Subproject 17-D-640- 020 is currently undergoing an Independent Cost Estimate and External Independent Review to support CD-2/3 approval. The Subproject 17-D-640-020 estimate is a Class 1 estimate. Further changes to the estimate/schedule may occur when the 17-D-640-020 Subproject completes design and obtains CD-2/3.

A Federal Project Director at the appropriate level has been assigned to this project.

Significant Changes:

Following are the changes from the previous version:

1. Growth in design funding for Subproject 17-D-640-020 reflects refined understanding of requirements (power, cooling, etc.) and the significant amount of re-work necessary to reflect the changes.
2. The estimate and schedule have been revised to reflect the additional design and associated delays.
3. The design delays combined with supply chain issues resulting from COVID (i.e. increased material/equipment costs and extended delivery schedules) and the change in the fire extinguishing system to hybrid/mist have increased the total project cost range.
4. CD-2/3 for 17-D-640-020 was moved from 4Q FY 2021 to 3Q FY 2022 due to the additional design work.
5. Correct mistakes made in the FY 2022 Data Sheet submittal for the Subproject 17-D-640-010 Total Project Cost and CD-4 schedule.

Critical Milestone History

17-D-640: Total Project

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	9/25/2014	8/13/2015	1QFY2017	1QFY2019	2QFY2019	3QFY2019	N/A	3QFY2022
FY 2018	9/25/2014	8/13/2015	3QFY2017	4QFY2019	2QFY2019	4QFY2019	N/A	2QFY2023
FY 2019	9/25/2014	8/13/2015	08/09/2017	4QFY2019	2QFY2019	4QFY2019	N/A	2QFY2023
FY 2020	9/25/2014	8/13/2015	08/09/2017	2QFY2020	4QFY2019	2QFY2020	N/A	4QFY2025
FY 2021	9/25/2014	8/13/2015	08/09/2017	1QFY2021	3QFY2020	1QFY2021	N/A	4QFY2025
FY 2022	9/25/2014	8/13/2015	08/09/2017	4QFY2021	2QFY2021	4QFY2021	N/A	1QFY2026
FY 2023	9/25/2014	8/13/2015	08/09/2017	3QFY2022	3/11/2022	3QFY2022	N/A	1QFY2027

17-D-640-010: ECSE Access and Life Safety Infrastructure

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	9/25/2014	8/13/2015	1QFY2017	3QFY2017	4QFY2017	4QFY2017	N/A	2QFY2019
FY 2018	9/25/2014	8/13/2015	3QFY2017	2QFY2018	1QFY2018	2QFY2018	N/A	3QFY2020
FY 2019	9/25/2014	8/13/2015	08/09/2017	2QFY2019	3QFY2018	2QFY2019	N/A	2QFY2021
FY 2020	9/25/2014	8/13/2015	08/09/2017	2QFY2019	7/11/2018	2QFY2019	N/A	4QFY2023
FY 2021	9/25/2014	8/13/2015	08/09/2017	03/27/2019	7/11/2018	03/27/2019	N/A	4QFY2023
FY 2022	9/25/2014	8/13/2015	08/09/2017	03/27/2019	7/11/2018	03/27/2019	N/A	3QFY2022
FY 2023	9/25/2014	8/13/2015	08/09/2017	03/27/2019	7/11/2018	03/27/2019	N/A	4QFY2023

17-D-640-020: ECSE Laboratory and Support Infrastructure

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	9/25/2014	8/13/2015	1QFY2017	1QFY2019	2QFY2019	3QFY2019	N/A	3QFY2022
FY 2018	9/25/2014	8/13/2015	3QFY2017	4QFY2019	2QFY2019	4QFY2019	N/A	2QFY2023
FY 2019	9/25/2014	8/13/2015	08/09/2017	4QFY2019	2QFY2019	4QFY2019	N/A	2QFY2023
FY 2020	9/25/2014	8/13/2015	08/09/2017	2QFY2020	4QFY2019	2QFY2020	N/A	4QFY2025
FY 2021	9/25/2014	8/13/2015	08/09/2017	1QFY2021	3QFY2020	1QFY2021	N/A	4QFY2025
FY 2022	9/25/2014	8/13/2015	08/09/2017	4QFY2021	2QFY2021	4QFY2021	N/A	1QFY2026
FY 2023	9/25/2014	8/13/2015	08/09/2017	3QFY2022	3/11/2022	3QFY2022	N/A	1QFY2027

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3A – Approve Site Preparation
CD-3B – Approve Site Preparation
CD-3 – Approve Start of Construction/Execution
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout
Separate documentation will be submitted for combined CD-2/3 for each subproject

17-D-640-020: ECSE Laboratory and Support Infrastructure

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2021	1QFY2021	3QFY2020	N/A
FY 2022	4QFY2021	3QFY2021	N/A
FY 2023	1QFY2022	7/7/2021	8/30/2021

CD-3A – Site Preparation
CD-3B – Site Preparation

Project Cost History

17-D-640: Total Project

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	14,200	137,300	151,500	7,109	N/A	7,109	158,609
FY 2018	14,200	137,300	151,500	7,109	N/A	7,109	158,609
FY 2019	19,900	131,600	151,500	7,109	N/A	7,109	158,609
FY 2020	14,856	148,144	163,000	11,809	N/A	11,809	174,809
FY 2021	38,916	468,284	507,200	19,309	N/A	19,309	526,509
FY 2022	70,756	436,444	507,200	19,309	N/A	19,309	526,509
FY 2023	106,863	460,337	567,200	9,672	N/A	9,672	576,872

17-D-640-010: ECSE Access and Life Safety Infrastructure

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	2,700	23,940	26,640	981	N/A	981	27,621
FY 2018	2,700	23,940	26,640	981	N/A	981	27,621
FY 2019	8,400	38,240	46,640	981	N/A	981	47,621
FY 2020	3,356	44,784	48,140	1,981	N/A	1,981	50,121
FY 2021	3,356	44,784	48,140	1,981	N/A	1,981	50,121
FY 2022	3,356	46,074	49,430	1,398	N/A	1,398	50,828
FY 2023	3,356	45,374	48,730	1,391	N/A	1,391	50,121

17-D-640-020: ECSE Laboratory and Support Infrastructure

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	11,500	113,360	124,860	6,128	N/A	6,128	130,988
FY 2018	11,500	113,360	124,860	6,128	N/A	6,128	130,988
FY 2019	11,500	93,360	104,860	6,128	N/A	6,128	110,988
FY 2020	11,500	103,360	114,860	9,828	N/A	9,828	124,688
FY 2021	35,560	423,500	459,060	17,328	N/A	17,328	476,388
FY 2022	67,400	390,370	457,770	17,911	N/A	17,911	475,681
FY 2023	103,507	414,963	518,470	8,281	N/A	8,281	526,751

2. Project Scope and Justification

Scope

UCEP will perform mining and provide the supporting structures, systems, and components necessary to deploy the large Major Items of Equipment (MIE) diagnostic systems and experiments. The existing U1a Complex orthogonal U1a.100 and U1a.104 drifts will be used to minimize the need for new mining.

17-D-640-010 includes the design, mining, fabrication, construction, installation, and commissioning of the underground areas and systems in the U1a Complex to provide accessibility, a refuge station, adequate ventilation, and construction power for the ensuing subproject 17-D-640-020. This subproject is required to support any significant construction activity in the eastern portion of the U1a Complex. While driven by the same mission in the ECSE subprogram, it is a subproject that can be designed and completed separately from the other subproject.

17-D-640-020 includes the design, mining, fabrication, construction, installation, and commissioning of the ECSE Area and systems to provide MIE diagnostic/detector alcove drifts and mechanical equipment drifts. Also included are safety basis and readiness activities. The project underground scope includes an experimental room with containment plugs for experiment execution, process control system, safety interlock system, diagnostic clean rooms and diagnostic infrastructure, and ancillary systems (overhead handling systems, power, cooling, ventilation, process water and oil, instrument air, spill mitigation, and shielding). This subproject includes a CD-3A and CD-3B for site preparation. The CD-3A scope is site preparation underground and the new borehole. The CD-3B scope is site preparation above ground for lay down yard/construction trailers and relocation of existing facility infrastructure.

Justification

DOE Order 413.3B Critical Decision, *CD-0 Approve Mission Need,* was approved on September 25, 2014, for the "Enhanced Capabilities for Subcritical Experiments (ECSE) at the Nevada National Security Site, U1a Complex." On November 4, 2015, the intersection of the U1a.100 and U1a.104 Drifts within the U1a Complex at the Nevada National Security Site was determined to be the only viable location for ECSE. The enhancements to the U1a Complex included in this line item will provide the drifts and the supporting structures, systems, and components necessary for the deployment of the MIEs to diagnose the subcritical hydrodynamic integrated weapons experiments using plutonium.

NNSA plans long-term investments supporting plutonium science at the NNSS. NNSS is the only site in the United States for experiments combining high explosives and plutonium, a core capability for NNSA's Stockpile Stewardship Program.
Funds appropriated under this data sheet may be used for contracted support services to the Federal Program Manager and the Federal Project Director to conduct independent assessments of the planning and execution of this project required by DOE O 413.3B and to conduct technical reviews of design and construction documents.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. As allowed by DOE O 413.3B, work will be phased to improve overall efficiency.

OPCs are funded out of the Enhanced Capabilities for Subcritical Experiments subprogram under Stockpile Research, Technology, and Engineering.

Key Performance Parameters (KPPs)

The KPPs represent the minimum acceptable performance that the project must achieve.

Performance Measure	Completion Criteria
17-D-640-010: Ventilation and power sufficient to allow concurrent excavation for two headings east of the U1a.01 Drift	Documented in UCEP Subproject 010 Ventilation Plan; UCEP Electrical Load Calculation; Temporary Power Plan
17-D-640-010: An invert suitable for transport of ASD accelerator equipment between the U1h shaft station and U1a.104 Drift	Documented in Building Code Requirements for Structural Concrete; Invert Plan; Invert Sections; Cast-In-Place Concrete Specification
17-D-640-010: Direct access from the U1a.01 Drift to the U1a.104 Drift for equipment and personnel	Documented in General Arrangement Plan
17-D-640-010: Multiple egress pathways from the U1a.100 Drift and U1a.104 Drift to the U1a.01 Drift	Documented in General Arrangement Plan
17-D-640-010: Operational Refuge Station east of the U1a.01 Drift to accommodate the number of individuals anticipated to normally work in that area	Documented in NNSS Underground Facility Safety and Health Program Description; U1a.102D Drift Refuge Shelter Equipment
17-D-640-020: An invert suitable for installation of the ASD accelerator in the U1a.104 Drift	Documented in the revised Program Requirements Document and the revised Project Execution Plan
17-D-640-020: Utilities and mechanical systems sufficient to support operation and maintenance of the ASD accelerator in the U1a.104 Drift	Documented in the revised Program Requirements Document and the revised Project Execution Plan

Performance Measure	Completion Criteria
17-D-640-020: A zero room structure and mechanical systems that meet requirements for conducting subcritical experiments in the U1a.100 Drift	Documented in the revised Program Requirements Document and the revised Project Execution Plan
17-D-640-020: Infrastructure that supports installation of a centralized control of operation system of the ASD accelerator and NDSE source	Documented in the revised Program Requirements Document and the revised Project Execution Plan
17-D-640-020: Infrastructure that supports acquisition of experiment diagnostic data	Documented in the revised Program Requirements Document and the revised Project Execution Plan

3. Project Cost and Schedule

17-D-640-010: ECSE Access and Life Safety Infrastructure

(Dollars in Thousands)

		Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)				
	Design			
	FY 2017	2,675	2,675	330
	FY 2018	681	681	3,026
	Total, Design	**3,356**	**3,356**	**3,356**
	Construction			
	FY 2017	8,800	8,800	0
	FY 2018	14,484	14,484	0
	FY 2019	10,000	10,000	9,320
	FY 2020	2,000	2,000	16,300
	FY 2021	10,090	10,090	15,978
	FY 2022	0	0	3,276
	FY 2023	0	0	500
	Total, Construction	**45,374**	**45,374**	**45,374**
	Total Estimated Costs			
	FY 2017	11,475	11,475	330
	FY 2018	15,165	15,165	3,026
	FY 2019	10,000	10,000	9,320
	FY 2020	2,000	2,000	16,300
	FY 2021	10,090	10,090	15,978
	FY 2022	0	0	3,276
	FY 2023	0	0	500
	Total, TEC	**48,730**	**48,730**	**48,730**
Other Project Costs (OPC)				
	OPC, except D&D			
	FY 2015	281	281	281
	FY 2016	700	700	700
	FY 2017	0	0	0
	FY 2018	0	0	0
	FY 2019	0	0	0
	FY 2020	0	0	0
	FY 2021	0	0	0

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	410	410	110
FY 2023	0	0	300
Total OPC, except D&D	**1,391**	**1,391**	**1,391**
OPC D&D			
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
Total, OPC D&D	**0**	**0**	**0**
Total Other Project Costs			
FY 2015	281	281	281
FY 2016	700	700	700
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	410	410	110
FY 2023	0	0	300
Total, OPC	**1,391**	**1,391**	**1,391**
Total Project Costs (TPC)			
FY 2015	281	281	281
FY 2016	700	700	700
FY 2017	11,475	11,475	330
FY 2018	15,165	15,165	3,026
FY 2019	10,000	10,000	9,320
FY 2020	2,000	2,000	16,300
FY 2021	10,090	10,090	15,978
FY 2022	410	410	3,386
FY 2023	0	0	800
Grand Total	**50,121**	**50,121**	**50,121**

17-D-640-020: ECSE Laboratory and Support Infrastructure

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	25	25	25

	Budget Authority (Appropriations)	Obligations	Costs
FY 2018	6,935	6,935	1,045
FY 2019	10,000	10,000	11,060
FY 2020	33,000	33,000	32,675
FY 2021	36,008	36,008	33,688
FY 2022	17,539	17,539	25,014
Total, Design	**103,507**	**103,507**	**103,507**
Construction			
FY 2021	114,502	114,502	7,400
FY 2022	117,461	117,461	115,986
FY 2023	53,130	53,130	126,700
FY 2024	129,870	129,870	97,000
FY 2025	0	0	47,100
FY 2026	0	0	20,777
Total, Construction	**414,963**	**414,963**	**414,963**
Total Estimated Costs			
FY 2017	25	25	25
FY 2018	6,935	6,935	1,045
FY 2019	10,000	10,000	11,060
FY 2020	33,000	33,000	32,675
FY 2021	150,510	150,510	41,088
FY 2022	135,000	135,000	141,000
FY 2023	53,130	53,130	126,700
FY 2024	129,870	129,870	97,000
FY 2025	0	0	47,100
FY 2026	0	0	20,777
Total, TEC	**518,470**	**518,470**	**518,470**
Other Project Costs (OPC)			
OPC, except D&D			
FY 2016	2,628	2,628	2,128
FY 2017	1,700	1,700	1,700
FY 2018	1,000	1,000	1,000
FY 2019	0	0	500
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	2,953	2,953	0
FY 2026	0	0	2,453
FY 2027	0	0	500
Total OPC, except D&D	**8,281**	**8,281**	**8,281**
OPC D&D			
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0

	Budget Authority (Appropriations)	Obligations	Costs
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	0	0	0
FY 2026	0	0	0
FY 2027	0	0	0
Total, OPC D&D	**0**	**0**	**0**
Total Other Project Costs			
FY 2016	2,628	2,628	2,128
FY 2017	1,700	1,700	1,700
FY 2018	1,000	1,000	1,000
FY 2019	0	0	500
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	2,953	2,953	0
FY 2026	0	0	2,453
FY 2027	0	0	500
Total, OPC	**8,281**	**8,281**	**8,281**
Total Project Costs (TPC)			
FY 2016	2,628	2,628	2,128
FY 2017	1,725	1,725	1,725
FY 2018	7,935	7,935	2,045
FY 2019	10,000	10,000	11,560
FY 2020	33,000	33,000	32,675
FY 2021	150,510	150,510	41,088
FY 2022	135,000	135,000	141,000
FY 2023	53,130	53,130	126,700
FY 2024	129,870	129,870	97,000
FY 2025	2,953	2,953	47,100
FY 2026	0	0	23,230
FY 2027	0	0	500
Grand Total	**526,751**	**526,751**	**526,751**

17-D-640: Total Project

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	2,700	2,700	355
FY 2018	7,616	7,616	4,071
FY 2019	10,000	10,000	11,060
FY 2020	33,000	33,000	32,675
FY 2021	36,008	36,008	33,688
FY 2022	17,539	17,539	25,014
Total, Design	**106,863**	**106,863**	**106,863**
Construction			
FY 2017	8,800	8,800	0
FY 2018	14,484	14,484	0
FY 2019	10,000	10,000	9,320
FY 2020	2,000	2,000	16,300
FY 2021	124,592	124,592	23,378
FY 2022	117,461	117,461	119,262
FY 2023	53,130	53,130	127,200
FY 2024	129,870	129,870	97,000
FY 2025	0	0	47,100
FY 2026	0	0	20,777
Total, Construction	**460,337**	**460,337**	**460,337**
Total Estimated Costs			
FY 2017	11,500	11,500	355
FY 2018	22,100	22,100	4,071
FY 2019	20,000	20,000	20,380
FY 2020	35,000	35,000	48,975
FY 2021	160,600	160,600	57,066
FY 2022	135,000	135,000	144,276
FY 2023	53,130	53,130	127,200
FY 2024	129,870	129,870	97,000
FY 2025	0	0	47,100
FY 2026	0	0	20,777
Total, TEC	**567,200**	**567,200**	**567,200**
Other Project Costs (OPC)			
OPC, except D&D			
FY 2015	281	281	281
FY 2016	3,328	3,328	2,828
FY 2017	1,700	1,700	1,700
FY 2018	1,000	1,000	1,000
FY 2019	0	0	500
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	410	410	110

	Budget Authority (Appropriations)	Obligations	Costs
FY 2023	0	0	300
FY 2024	0	0	0
FY 2025	2,953	2,953	0
FY 2026	0	0	2,453
FY 2027	0	0	500
Total OPC, except D&D	**9,672**	**9,672**	**9,672**
OPC D&D			
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	0	0	0
FY 2026	0	0	0
FY 2027	0	0	0
Total, OPC D&D	**0**	**0**	**0**
Total Other Project Costs			
FY 2015	281	281	281
FY 2016	3,328	3,328	2,828
FY 2017	1,700	1,700	1,700
FY 2018	1,000	1,000	1,000
FY 2019	0	0	500
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	410	410	110
FY 2023	0	0	300
FY 2024	0	0	0
FY 2025	2,953	2,953	0
FY 2026	0	0	2,453
FY 2027	0	0	500
Total, OPC	**9,672**	**9,672**	**9,672**
Total Project Costs (TPC)			
FY 2015	281	281	281
FY 2016	3,328	3,328	2,828
FY 2017	13,200	13,200	2,055
FY 2018	23,100	23,100	5,071
FY 2019	20,000	20,000	20,880
FY 2020	35,000	35,000	48,975
FY 2021	160,600	160,600	57,066
FY 2022	135,410	135,410	144,386
FY 2023	53,130	53,130	127,500

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	129,870	129,870	97,000
FY 2025	2,953	2,953	47,100
FY 2026	0	0	23,230
FY 2027	0	0	500
Grand Total	**576,872**	**576,872**	**576,872**

4. Details of Project Cost Estimate

17-D-640-010: ECSE Access and Life Safety Infrastructure

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	2,852	2,852	2,852
Project Management	504	504	504
Contingency	0	0	0
Total, Design	**3,356**	**3,356**	**3,356**
Construction			
Site Work	0	0	0
Equipment	0	0	0
Construction	34,234	32,896	31,606
Construction Management	5,368	5,368	5,368
Contingency	5,772	7,810	7,810
Total, Construction	**45,374**	**46,074**	**44,784**
Total Estimated Cost	**48,730**	**49,430**	**48,140**
Contingency, TEC	*5,772*	*7,810*	*7,810*
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	200	200	200
Conceptual Design	281	281	281
Other OPC Costs	910	917	1,500
Contingency	0	0	0
Total, OPC	1,391	1,398	1,981
Contingency, OPC	*0*	*0*	*0*
Total Project Cost	**50,121**	**50,828**	**50,121**
Total Contingency (TEC+OPC)	**5,772**	**7,810**	**7,810**

17-D-640-020: ECSE Laboratory and Support Infrastructure

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	68,355	42,653	N/A
Project Management	35,152	20,947	N/A
Contingency	0	3,800	N/A
Total, Design	**103,507**	**67,400**	**N/A**
Construction			
Site Work	0	0	N/A
Equipment	0	0	N/A
Construction	316,863	266,000	N/A
Construction Management	62,600	41,925	N/A
Contingency	35,500	82,445	N/A
Total, Construction	**414,963**	**390,370**	**N/A**
Total Estimated Cost	**518,470**	**457,770**	N/A
Contingency, TEC	*35,500*	*86,245*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	300	300	N/A
Conceptual Design	728	728	N/A
Other OPC Costs	7,253	16,083	N/A
Contingency	0	800	N/A
Total, OPC	8,281	17,911	N/A
Contingency, OPC	*0*	*800*	*N/A*
Total Project Cost	**526,751**	**475,681**	**N/A**
Total Contingency (TEC+OPC)	**35,500**	**87,045**	**N/A**

17-D-640: Total Project

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	71,207	45,505	N/A
Project Management	35,656	21,451	N/A
Contingency	0	3,800	N/A
Total, Design	**106,863**	**70,756**	**N/A**
Construction			
Site Work	0	0	N/A
Equipment	0	0	N/A
Construction	351,097	298,896	N/A
Construction Management	67,968	47,293	N/A
Contingency	41,272	90,255	N/A
Total, Construction	**460,337**	**436,444**	**N/A**
Total Estimated Cost	**567,200**	**507,200**	N/A
Contingency, TEC	*41,272*	*94,055*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	500	500	N/A
Conceptual Design	1,009	1,009	N/A
Other OPC Costs	8,163	17,000	N/A
Contingency	0	800	N/A
Total, OPC	9,672	19,309	N/A
Contingency, OPC	*0*	*800*	*N/A*
Total Project Cost	**576,872**	**526,509**	**N/A**
Total Contingency (TEC+OPC)	***41,272***	***94,855***	***N/A***

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	Total
FY 2017	TEC	131,600	19,900	0	0	0	0	0	151,500
	OPC	7,109	0	0	0	0	0	0	7,109
	TPC	138,709	19,900	0	0	0	0	0	158,609
FY 2018	TEC	131,600	19,900	0	0	0	0	0	151,500
	OPC	7,109	0	0	0	0	0	0	7,109
	TPC	138,700	19,900	0	0	0	0	0	158,609
FY 2019	TEC	121,600	29,900	0	0	0	0	0	151,500
	OPC	7,109	0	0	0	0	0	0	7,109
	TPC	128,700	29,900	0	0	0	0	0	158,609
FY 2020	TEC	88,600	48,800	25,600	0	0	0	0	163,000
	OPC	6,309	0	1,000	0	4,500	0	0	11,809
	TPC	94,909	48,800	26,600	0	4,500	0	0	174,809
FY 2021	TEC	88,600	160,600	135,000	123,000	0	0	0	507,200
	OPC	6,309	0	0	3,000	10,000	0	0	19,309
	TPC	94,909	160,600	135,000	126,000	10,000	0	0	526,509
FY 2022	TEC	88,600	160,600	135,000	123,000	0	0	0	507,200
	OPC	6,309	417	0	2,583	10,000	0	0	19,309
	TPC	94,909	161,017	135,000	125,583	10,000	0	0	526,509
FY 2023	TEC	88,600	160,600	135,000	53,130	129,870	0	0	567,200
	OPC	6,309	0	410	0	0	2,953	0	9,672
	TPC	94,909	160,600	135,410	53,130	129,870	2,953	0	576,872

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY2027
Expected Useful Life	30
Expected Future Start of D&D of this capital asset	1Q FY 2057

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	36	36	1,075	1,080

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

8. Acquisition Approach

The project is being managed by the NNSS Management and Operating (M&O) contractor because of operations within the U1a Complex, which is an underground facility with limited access. Design and construction of the underground modifications will be performed by the NNSS M&O contractor through CLIN 001 on the M&O cost-plus contract.

Advanced Sources and Detectors (ASD) Major Item of Equipment (MIE)
LANL Lead (SNL, LLNL, NNSS, NRL support)
Project Data Sheet

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2023 Request for the ASD MIE is $247,065,000. The cost range for this project has changed to $500,000,000 - $1,300,000,000 due to COVID delays and supply chain challenges.

A Federal Project Director at the appropriate level has been assigned to this project.

Significant Changes:

- Revised Financial Schedule to reflect changes from near-term to outyear budget and spend.
- Changed Performance Baseline Validation date to the third quarter of FY 2022, Critical Decision (CD)-2/3 approval to the fourth quarter of FY 2022, and CD-4 to the third quarter FY 2027 due to COVID impacts and supply chain delays.
  - As a result of the pandemic, Lawrence Livermore National Laboratory and Los Alamos National Laboratory stopped all hands on work for several months.
  - The project experienced supply chain issues (i.e. increased material/equipment costs and extended delivery schedules) due to COVID impacts. These supply chain issues caused downstream delays in the execution of technology maturation and design, which are necessary to achieve CD-2/3C. These supply chain issues have also increased project costs and delayed delivery of the CD-3B long-lead procurements.
- Delays in completion of the U1a Complex Enhancements Project design and extension of the construction schedule have resulted in delays in the installation of ASD in the U1a facility resulting in an extension to the project and increased cost.
- Revised Work Breakdown Structure to align with the planned execution of work.

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3C	CD-4
FY 2020	9/25/2014	6/7/2018	2/6/2019	2Q FY 2022	4Q FY 2021	2Q FY 2022	4Q FY 2025
FY 2021	9/25/2014	6/7/2018	2/6/2019	2Q FY 2022	4Q FY 2021	2Q FY 2022	4Q FY 2025
FY 2022	9/25/2014	6/7/2018	2/6/2019	2Q FY 2022	4Q FY 2021	2Q FY 2022	4Q FY 2025
FY 2023	9/25/2014	6/7/2018	2/6/2019	4Q FY 2022	3Q FY 2022	4Q FY 2022	3Q FY 2027

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-3A – Approve Long Lead Procurements – Scintillator components
CD-3B – Approve Long Lead Procurements – Injector and Pulsed power components
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Fabrication
CD-4 – Approve Start of Operations or Project Closeout

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2020	4Q FY 2021	3Q FY 2021	
FY 2021	4Q FY 2021	3Q FY 2021	
FY 2022	4Q FY 2021	3Q FY 2021	1Q FY 2022
FY 2023	3Q FY 2022	4/13/2021	1/3/2022

Project Cost History

(Dollars in Thousands)

Fiscal Year	Total Cost
FY 2020	791,600
FY 2021	1,061,355
FY 2022	939,655
FY 2023	1,284,161

2. Project Scope and Justification

Scope

Enhanced Capabilities for Subcritical Experiments (ECSE) portfolio aims to construct a new underground laboratory in Nevada and to install large modern diagnostic systems necessary to evaluate plutonium implosion system experiments in support of the current and future stockpile. The ASD MIE is one of these diagnostic systems that involves installation of a linear induction accelerator into the U1a Complex. The ASD MIE will provide the capability to conduct weapons-scale, radiographically diagnosed subcritical experiments using special nuclear material (SNM). The radiographic data is required to refine the modern predictive physics models used to certify the present and future stockpile. Radiography (x-ray imaging of dense objects) is the principal tool for diagnosing dynamic weapons-scale experiments and is the key diagnostic for the National Hydrodynamic Test Program at both Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL). Currently, NNSA relies on hydrodynamic tests at the Dual Axis Radiographic Hydrodynamic Test Facility (DARHT) at LANL and at LLNL's Contained Firing Facility using the Flash X-Ray machine. In these tests, surrogate materials replace SNM in the experimental assembly. The surrogate tests explore many significant aspects of primary implosion physics, but cannot explore the unique behavior of plutonium. The ASD MIE Project, funded within the ECSE subprogram, addresses this need and complements other diagnostics already supporting the subcritical, scaled experiments program.

The ASD Project is composed of an MIE (called Scorpius) for four-pulse, single-axis radiographic capability at weapons-relevant scales to be integrated with the UCEP Line Item-funded infrastructure improvements, which will house the MIE. The ASD Project is responsible for the technology maturation, design, fabrication and installation, and commissioning of Scorpius through CD-4. The CD-3A long-lead procurement scope is for the procurement of the scintillator and imager. The CD-3B long-lead procurement scope is for components/materials to support the fabrication of the Injector and setup of the Integrated Test Stand.

Justification

The aggregate influences of aging, modern manufacturing techniques, modern materials, and evolving design philosophies are driving the stockpile toward the limits of the nuclear explosive testing database. In 2014, LANL and LLNL jointly identified a capability gap that challenges the ability to certify the stockpile in light of these changes, which involves the evaluation of plutonium response. In 2016, the JASON Defense Advisory Group identified the same gap in capability of the United States to carry out and diagnose such experiments. The ASD MIE, as part of ECSE, is designed to narrow this gap. Radiographic data from ECSE will help the validation of the W80-4 design and certification of the W87-1 Modification Program. ECSE delivery in the mid-2020s supports these efforts. Funds appropriated under this data sheet may be used for contracted support services to the Federal Program Manager and the Federal Project Director to conduct independent assessments of the planning and execution of this project required by DOE O 413.3B and to conduct technical reviews of design and construction documents.

Key Performance Parameters (KPPs)

The KPPs and Initial Operational Capability (IOC) represent the minimum acceptable performance that the project must achieve. Achievement of the KPPs will be a prerequisite for approval of CD-4, Project Completion. KPPs will be included upon approval of CD-2/3. In summary, the MIE must be able to generate the x-ray energies and multi-pulse capability necessary to diagnose late-time dynamics in plutonium implosion experiments.

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget	Obligations	Costs
Funding			
FY 2015	10,500	10,500	3,130
FY 2016	10,500	10,500	6,463
FY 2017	7,500	7,500	14,207
FY 2018	34,395	34,395	32,531
FY 2019	50,000	50,000	51,746
FY 2020	112,160	112,160	82,700
FY 2021	166,752	166,752	143,823
FY 2022	174,685	174,685	226,700
FY 2023	247,065	247,065	247,300
FY 2024	250,300	250,300	249,840
FY 2025	150,304	150,304	111,700
FY 2026	70,000	70,000	84,890
FY 2027	0	0	29,131
Grand Total	**1,284,161**	**1,284,161**	**1,284,161**

4. Details of Project Cost Estimate

Work Breakdown Structure Estimated Cost (Dollars in Thousands)

WBS #	WBS Title	Current Estimate	Previous Estimate
1.01	Project Management	109,000	80,800
1.02	Radiographic System	787,000	559,600
1.03	System Engineering and Requirements	20,300	13,200
1.04	ITS Facility Installation, Major Subsystem Installation, Integration, & Testing	58,300	19,600
1.05	U1a Final Major Subsystem Installation, Integration, & Testing	59,600	10,000
1.06	Final Commissioning at U1a	24,800	N/A
	Management Reserve/Contingency	225,161	256,455
	Total	**1,284,161**	**939,655**

5. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	3Q FY 2027
Expected Useful Life	30 years
Expected Future Start of D&D of this capital asset	3Q FY 2057

6. Acquisition Approach

The four Management and Operations contractors at the Laboratories and sites (LANL, LLNL, SNL, and NNSS) have formed a multi-site team to execute the Project. This management team structure encourages the full engagement of LANL, LLNL, SNL and NNSS, enabling the NNSA to leverage unique capabilities of each laboratory. It also unifies the design to construction process, which is especially important, as the U1a Complex is an underground facility with limited access.

Infrastructure and Operations

Overview
The Infrastructure and Operations program maintains, operates, and modernizes the National Nuclear Security Administration (NNSA) infrastructure in a safe, secure, and cost-effective manner to support all NNSA programs. Infrastructure and Operations efforts provide a comprehensive approach to modernizing NNSA infrastructure while maximizing return on investment, enabling program results, and reducing enterprise risk. The program also plans, prioritizes, and constructs mission-enabling facilities and infrastructure. Starting in FY 2023, funding for programmatic construction is requested within the program the project most closely supports. Further, funding for Capability Based Investments and Planning for Programmatic Construction is requested within Production Modernization.

Operations of Facilities
The Operations of Facilities program provides the funding required to operate NNSA facilities in a safe and secure manner and is fundamental to achieving NNSA's plutonium, uranium, tritium, lithium, high explosives, and other mission objectives. This program includes essential support such as water and electrical utilities; safety systems; lease agreements; and activities associated with Federal, state, and local environmental, worker safety, and health regulations.

Safety and Environmental Operations
The Safety and Environmental Operations program provides for the Department's Nuclear Criticality Safety Program (NCSP), Nuclear Safety Research and Development (NSR&D), Packaging subprogram, Long Term Stewardship (LTS) subprogram and Nuclear Materials Integration (NMI) subprogram. These activities support safe, efficient operation of the nuclear security enterprise through the provision of safety data, nuclear material packaging, environmental monitoring, and nuclear material tracking.

Maintenance and Repair of Facilities
The Maintenance and Repair of Facilities program (Maintenance) provides direct-funded maintenance activities across the NNSA enterprise for the recurring day-to-day work required to sustain and preserve NNSA facilities in a condition suitable for their designated purpose. These efforts include predictive, preventive, and corrective maintenance activities to maintain facilities, property, assets, systems, roads, and vital safety systems.

Recapitalization
The Recapitalization program, comprised of the Infrastructure and Safety subprogram, is key to modernizing NNSA's infrastructure. A sustained investment in Recapitalization is needed to address numerous obsolete support and safety systems; revitalize facilities that are beyond the end of their design life; address climate adaptability and resilience; and improve the reliability, efficiency, and capability of core infrastructure to meet mission requirements. The Recapitalization program modernizes NNSA infrastructure by prioritizing investments to improve the condition and extend the life of structures, capabilities, and systems thereby improving the safety and quality of the workplace. Recapitalization investments help achieve operational efficiencies and reduce safety, security, environmental, climate, and program risk.

The Recapitalization program includes minor construction and infrastructure upgrade projects, real property purchases, planning, and Other Project Costs (OPC) for Infrastructure and Operations funded mission enabling infrastructure, and deactivation and disposal of excess infrastructure.

NNSA uses a prioritization methodology for recapitalization investments that factors in sustainability. This prioritization methodology focuses NNSA's infrastructure recapitalization investments on reducing safety risk and mission risk (which incorporate climate risk) while improving sustainability increasing return on investment and reducing deferred maintenance. As NNSA continues to mature its sustainability approach, the Site Sustainability Plans (SSP) will identify each site's respective contribution toward meeting the Department's sustainability and climate action goals.

Line-Item Construction
Infrastructure and Operations line-item construction projects are critical to revitalizing the infrastructure. These projects will replace obsolete, unreliable facilities and infrastructure to reduce safety and program risk while improving responsiveness, capacity, and capabilities. NNSA uses a prioritization methodology for mission enabling line-item

construction that evaluates investments on closing mission gaps, reducing infrastructure risk and safety risk, improving sustainability, and reducing deferred maintenance.

Highlights of the FY 2023 Budget Request

The FY 2023 Budget Request for Infrastructure and Operations totals $2,630,963,000 which enables the long-term effort to modernize NNSA infrastructure. All requested amounts reflect a reduction in the program's allocated share of reimbursements for pension contributions at Sandia National Laboratories (SNL), Lawrence Livermore National Laboratory (LLNL), and Los Alamos National Laboratory (LANL). This request includes an increase to Operations of Facilities to support: the Plutonium Modernization mission, including the production of at least 30 pits per year at Los Alamos National Laboratory (LANL); operations support personnel to complete 100% of the Savannah River Site (SRS) mission deliverables including Life Extension Program (LEP) requirements and Gas Transfer System (GTS) Surveillance requirements per schedule; and increased safety basis at Pantex. The increase is partially offset by a transfer of scope for programmatic equipment maintenance at SNL to the Production Operations program. The increase in Maintenance and Repair of Facilities also supports the Plutonium Modernization mission, including the production of at least 30 pits per year at LANL, increased maintenance needs at SNL to support the Microsystems Engineering, Science and Applications (MESA) Extended Life Program (ELP), and the transfer of the Waste Solidification Building (WSB) at the Savannah River Site (SRS) from the Material Management and Minimization's Material Disposition subprogram within Defense Nuclear Nonproliferation (DNN). The increase is partially offset by a transfer of scope for programmatic equipment maintenance at Kansas City National Security Campus (KCNSC) to the Production Operations program. The decrease to the Safety and Environmental Operations program reflects a small adjustment to reduce uncosted balances. This is offset by an increase for additional support for the Material Managers at the sites under the Nuclear Materials Integration program. The overall decrease to Recapitalization, Infrastructure and Safety program reflects a realignment to Mission Enabling Construction to address larger projects. This is partially offset by an increase for planning to support the U1a Complex Access Shaft project at Nevada National Security Site (NNSS). NNSA is also increasing emphasis on climate resiliency projects within the program through the Energy Resilient Infrastructure and Climate Adaptation (ERICA) initiative. The request for Mission Enabling Construction is to support new starts for the Electrical Power Capacity Upgrade project at LANL, Plutonium Modernization Operations & Waste Management Office Building at LANL, and construction for the Special Materials Facility project at Y-12 National Security Campus (Y-12). It also supports the transition to construction for the Digital Infrastructure Capability Expansion project at LLNL.

The request also reflects a budget structure change realigning the Capability Based Investments subprogram from Recapitalization to Production Modernization. It also realigns Programmatic Construction projects to their relevant portfolios (Production Modernization or Stockpile Research, Technology, and Engineering). Unless otherwise noted, budget tables included in the NNSA Congressional Budget Justification show the FY 2021 Enacted Level on a comparable basis to what is proposed for FY 2023.

Major Outyear Priorities and Assumptions

Outyear funding levels for Infrastructure and Operations total $11,483,722,000 for FY 2024 through FY 2027. Outyear priorities will focus on supporting the pit production mission, life extension mission, and the Infrastructure Modernization Initiative (IMI) goal of reducing Deferred Maintenance (DM) and Repair Needs (RN) and continuing to modernize NNSA's infrastructure to reduce mission and safety risks through the application of an enterprise risk management methodology, with line item construction investments largely directed to mission enabling, plutonium, and weapons assembly and disassembly infrastructure. NNSA also seeks to enhance climate adaptation and energy resilience as part of its overall infrastructure modernization strategy. Lastly, NNSA will seek operational efficiencies by deactivating and dispositioning facilities that are no longer needed, thereby reducing operations, maintenance, and recapitalization requirements.

Infrastructure Modernization Initiative

In the FY 2022 National Defense Authorization Act (NDAA), Congress amended the IMI to require reducing Deferred Maintenance (DM) by replacement plant value (RPV) by not less than 45 percent by 2030 and authorizing NNSA to dispose of process-contaminated facilities if the total project cost is estimated to be under $75 million.

As part of the IMI, NNSA has deployed BUILDER, a system developed by the U.S. Army Corps of Engineers and recognized by the National Academy of Sciences as a best-in-class practice for infrastructure management. The BUILDER system uses comprehensive inventory, lifecycle, cost, and assessment data and risk-informed standards and policies to recommend repairs and replacements at the most opportune time, thus improving NNSA's ability to pinpoint and prioritize investments. Using BUILDER-based calculations provides a more accurate and transparent understanding of NNSA's infrastructure. Historical approaches had greatly underestimated the Replacement Plant Value (RPV) of NNSA's facilities (for example, RPV for Y-12's 9212 was historically $949 million and is now $4.7 billion). NNSA's new calculated RPV is $124.9 billion, of which $3.5 billion is excess facilities. The DM costs are tied to the RPV (it costs more to repair a more expensive facility); therefore, as expected, DM increased with the deployment of our new, more accurate, data-driven approach from $5.8 billion as of FY 2020 to $6.1 billion as of FY 2021. The overall physical condition of NNSA's infrastructure did not decline. (Table 1).

As a result of our data-driven and risk-informed infrastructure tools, NNSA has transitioned from a financially driven (e.g., DM) to a risk-driven plan for improving infrastructure. While many of our projects will inherently reduce DM, DM reduction is not the primary metric driving project selection.

Table 1

NNSA Deferred Maintenance (DM) as a Percentage of Replacement Plant Value (RPV)

Metric	FY 2019	FY 2020	FY 2021
RN	$8.9B	$9.4B	$9.8B
DM	$4.8B	$5.8B	$6.1B
RPV	$124.3B	$116.3B	$124.9B
RN/RPV Ratio	7.16%	8.08%	7.88%
DM/RPV Ratio	3.85%	4.99%	4.90%

In response to GAO recommendations, the following information is provided to improve transparency in the budget. Table 2 below lists total DM at NNSA sites, including a breakdown of that DM at different stages of facilities' design lives.

Table 2

NNSA Deferred Maintenance (DM) as of FY 2021 (dollars in thousands)

Metric	Total	% of Total DM	RPV	DM/RPV
Total DM	6,125,739	100%	124,923,660	4.90%
DM on excess facilities	53,317	0.87%	3,454,190	1.54%
DM on facilities beyond their 40-year design life	4,270,974	69.72%	70,547,990	6.05%
DM on facilities within ten years of their 40-year design life	1,221,454	19.94%	19,486,430	6.27%
DM on facilities within the first 30 years of their 40-year design life	579,994	9.47%	31,435,050	1.85%

Approximately 90 percent of NNSA DM is associated with facilities that are approaching or surpassed their 40-year design life. As part of a prudent investment strategy, NNSA will intentionally not perform some of the maintenance and repair on facilities with near-term replacement strategies or those that are or soon will become excess. NNSA is prioritizing its investments based on reducing mission risk, and it will take time and sustained investment in new construction to replace aged facilities and reverse operational risks from this legacy infrastructure.

NNSA annually screens excess facilities to identify the highest risks to mission, workers, the public, and the environment to support risk-informed decision making. Table 3 lists the highest-risk facilities.

Table 3			
NNSA's Highest-Risk Excess Facilities[a]			
Site	**Facility**	**Year Built**	**Year Shut Down**
Y-12	Alpha 5, Building 9201-05	1944	1983
Y-12	Beta 4, Building 9204-04	1945	2007
Y-12	Building 9206	1944	1993
Y-12	Warehouse/Industrial, Building 9720-17[b]	1956	2016
LLNL	Heavy Elements Facility, Building 251	1956	1995
LLNL	Livermore Pool-Type Reactor, Building 280	1956	1980
LLNL	Rotating Target Neutron Source Facility, Building 292	1979	1987
LLNL	Pluto Project Testing and Fabrication Facility, Building 241	1960	2008
LLNL	Explosives & High-Pressure Testing, Building 343	1960	2014
LANL	Ion Beam Facility, Building TA-3-0016	1953	1999
LANL	Plastics Building 16-0306	1954	2009

[a] The FY 2022 table included the MARS-E Beam, Building 175 at LLNL, which was dispositioned in November 2021.
[b] Facility contains radiological and/or hazardous contamination based on historical use.

Infrastructure and Operations
Funding (Comparable)

	(Dollars in Thousands)				
	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Infrastructure and Operations					
Operating					
Operations of Facilities	**1,014,000**	**1,014,000**	**1,038,000**	**+24,000**	**+2.4%**
Safety and Environmental Operations	**165,354**	**165,354**	**162,000**	**-3,354**	**-2.0%**
Maintenance and Repair of Facilities	**667,000**	**667,000**	**680,000**	**+13,000**	**+1.9%**
Recapitalization					
Infrastructure and Safety	573,717	573,717	561,663	-12,054	-2.1%
Subtotal, Recapitalization	**573,717**	**573,717**	**561,663**	**-12,054**	**-2.1%**
Total, Operating	**2,420,071**	**2,420,071**	**2,441,663**	**+21,592**	**+0.9%**
Construction					
Mission Enabling Construction					
23-D-519, Special Material Facility, Y-12	0	0	49,500	+49,500	0%
23-D-518, Plutonium Modernization Operations & Waste Management Office Building, LANL	0	0	48,500	+48,500	0%
23-D-517, Electrical Power Capacity Upgrade, LANL	0	0	24,000	+24,000	0%
22-D-514, Digital Infrastructure Capability Expansion, LLNL	0	0	67,300	+67,300	0%
19-D-670, 138kV Power Transmission System Replacement, NNSS	59,000	59,000	0	-59,000	-100.0%
15-D-612, Emergency Operations Center, LLNL	27,000	27,000	0	-27,000	-100.0%
15-D-611, Emergency Operations Center, SNL	36,000	36,000	0	-36,000	-100.0%
Total, Mission Enabling Construction	**122,000**	**122,000**	**189,300**	**+67,300**	**+55.2%**
Total, Infrastructure and Operations	**2,542,071**	**2,542,071**	**2,630,963**	**+88,892**	**+3.5%**

Infrastructure and Operations
Outyear Funding

	(Dollars in Thousands)			
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Infrastructure and Operations				
Operating				
Operations of Facilities	**1,144,000**	**1,182,000**	**1,222,000**	**1,250,000**
Safety and Environmental Operations	**161,000**	**167,000**	**167,000**	**171,000**
Maintenance and Repair of Facilities	**711,000**	**727,000**	**743,000**	**751,000**
Recapitalization				
Infrastructure and Safety	**580,470**	**582,220**	**604,204**	**666,428**
Subtotal, Recapitalization	**580,470**	**582,220**	**604,204**	**666,428**
Total, Operating	**2,596,470**	**2,658,220**	**2,736,204**	**2,838,428**
Mission Enabling Construction				
27-D-XXX, Plutonium Engineering Support Building, LANL	0	0	0	48,700
26-D-XXX, U1a Complex Access Shaft, NNSS	0	0	30,000	85,000
26-D-XXX, Plutonium Program Accounting Building, LANL	0	0	48,700	0
25-D-XXX, Plutonium Mission Safety & Quality Building, LANL	0	48,500	0	0
25 D-XXX, Maintenance Facility, Y-12	0	50,000	0	0
24-D-XXX, Analytic Gas Laboratory, PX	35,000	0	0	0
24-D-XXX, Plutonium Production Building, LANL	48,500	0	0	0
23-D-517, Electrical Power Capacity Upgrade, LANL	95,000	86,000	79,000	0
Total, Construction	**178,500**	**184,500**	**157,700**	**133,700**
Total, Infrastructure and Operations	**2,774,970**	**2,842,720**	**2,893,904**	**2,972,128**

Infrastructure and Operations
Funding (Non-Comparable)

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Infrastructure and Operations					
Operating					
Operations of Facilities	**1,014,000**	**1,014,000**	**1,038,000**	**24,000**	**+2.4%**
Safety and Environmental Operations	**165,354**	**165,354**	**162,000**	**-3,354**	**-2.0%**
Maintenance and Repair of Facilities	**667,000**	**667,000**	**680,000**	**13,000**	**+1.9%**
Recapitalization					
Infrastructure and Safety	573,717	573,717	561,663	-12,054	-2.1%
Capability Based Investments	149,117	149,117	0	-149,117	-100.0%
Planning for Programmatic Construction (Pre-CD-1)	10,000	10,000	0	-10,000	-100.0%
Subtotal, Recapitalization	**732,834**	**732,834**	**561,663**	**-171,171**	**-23.4%**
Total, Operating	**2,579,188**	**2,579,188**	**2,441,663**	**-137,525**	**-5.3%**
Construction					
Programmatic Construction					
Mission Enabling Construction	1,386,319	1,386,319	0	-1,386,319	-100.0%
Total, Construction	122,000	122,000	189,300	67,300	+55.2%
Total, Infrastructure and Operations	**1,508,319**	**1,508,319**	**189,300**	**-1,319,019**	**-87.4%**
	4,087,507	**4,087,507**	**2,630,963**	**-1,456,544**	**-35.6%**

FY 2021 Budget Structure	FY 2023 Budget Structure FY 2021 Enacted Comparable									
	Production Modernization							Stockpile Reseach, Technology, and Engineering		
	Los Alamos Pu Modernization	High Explosives & Energetics	Secondary Capability Modernization	Tritium and Domestic Uranium Enrichment	Non-Nuclear Capability Modernizaiton	Capability Based Investments	Warhead Assembly	Assessment Science	Advanced Simulation and Computing	Total
Weapons Activities										
Infrastructure and Operations										
Operating										
Operations of Facilities										0
Safety and Environmental Operations										0
Maintenance and Repair of Facilities										0
Recapitalization										0
Infrastructure and Safety										0
Capability Based Investments						154,220				154,220
Subtotal, Recapitalization	0	0	0	0	0	154,220		0	0	154,220
Total, Operating	0	0	0	0	0	154,220		0	0	154,220
I&O: Construction										
Programmatic										
22-D-513, Power Sources Capability, SNL					0					0
21-D-510, HE Synthesis, Formulation, and Production, PX		108,000								108,000
18-D-690, Lithium Processing Facility, Y-12			216,886							216,886
18-D-680 Material Staging Facility, PX							0			0
18-D-650, Tritium Finishing Facility, SRS				73,300						73,300
18-D-620 Exascale Computing Facility Modernization Project, LLNL									0	0
17-D-640, U1a Complex Enhancements Project, NNSS								53,130		53,130
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL	30,002									30,002
15-D-301 HE Science & Engineering Facility, PX		20,000								20,000
07-D-220-04 Transuranic Liquid Waste Facility, LANL	24,759									24,759
06-D-141, Uranium Processing Facility, Y-12			362,000							362,000
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL	162,012									162,012
Total, Programmatic	216,773	128,000	578,886	73,300	0	0	0	53,130	0	1,050,089
Mission Enabling										
Total, Mission Enabling	0	0	0	0	0	0	0	0	0	0
Total, I&O: Construction	216,773	128,000	578,886	73,300	0	0	0	53,130	0	1,050,089
Total, Infrastructure and Operations	**216,773**	**128,000**	**578,886**	**73,300**	**0**	**154,220**	**0**	**53,130**	**0**	**1,204,309**

FY 2021 Budget Structure	FY 2023 Budget Structure FY 2021 Enacted Non-Comparable													
	Infrastructure and Operations					Production Modernization						Stockpile Reseach, Technology, and Engineering		
	Operations of Facilities	Safety and Environmental Operations	Maintenance and Repair of Facilities	Recapitalization	Mission Enabling Construction	Los Alamos Pu Modernization	Secondary Capability Modernization	Tritium and Domestic Uranium Enrichment	High Explosives & Energetics	Capability Based Investments	Planning for Programmatic Construction (Pre-CD-1)	Assessment Science	Advanced Simulation and Computing	Total
Weapons Activities														
Infrastructure and Operations														
Operating														
Operations of Facilities	1,014,000													1,014,000
Safety and Environmental Operations		165,354												165,354
Maintenance and Repair of Facilities			667,000											667,000
Recapitalization														0
Infrastructure and Safety				573,717										573,717
Capability Based Investments										149,117				149,117
Planning for Programmatic Construction (Pre-CD-											10,000			10,000
Subtotal, Recapitalization	0	0	0	573,717	0	0	0	0	0	149,117	10,000	0	0	732,834
Total, Operating	1,014,000	165,354	667,000	573,717	0	0	0	0	0	149,117	10,000	0	0	2,579,188
I&O: Construction														
Programmatic														
21-D-510, HE Synthesis, Formulation, and Production, PX									31,000					31,000
18-D-690, Lithium Processing Facility, Y-12							109,405							109,405
18-D-680 Material Staging Facility, PX														0
18-D-650, Tritium Finishing Facility, SRS								27,000						27,000
18-D-620 Exascale Computing Facility Modernization Project, LLNL													29,200	29,200
17-D-640, U1a Complex Enhancements Project, NNSS												160,600		160,600
15-D-302, TA-55 Reinvestments Project, Phase 3, LANL						30,000								30,000
15-D-301 HE Science & Engineering Facility, PX									43,000					43,000
07-D-220-04 Transuranic Liquid Waste Facility, LANL						36,687								36,687
06-D-141, Uranium Processing Facility, Y-12							750,000							750,000
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL						169,427								169,427
Total, Programmatic	0	0	0	0	0	236,114	859,405	27,000	74,000	0	0	160,600	29,200	1,386,319
Mission Enabling					122,000									122,000
Total, Mission Enabling	0	0	0	0	122,000	0	0	0	0	0	0	0	0	122,000
Total, I&O: Construction	0	0	0	0	122,000	236,114	859,405	27,000	74,000	0	0	160,600	29,200	1,508,319
Total, Infrastructure and Operations	**1,014,000**	**165,354**	**667,000**	**573,717**	**122,000**	**236,114**	**859,405**	**27,000**	**74,000**	**149,117**	**10,000**	**160,600**	**29,200**	**4,087,507**

Infrastructure and Operations
Explanation of Major Changes
(Dollars in Thousands)

	FY 2023 Request vs FY 2021 Enacted ($)
Infrastructure and Operations	
Operating	
Operations of Facilities: The increase supports: the Plutonium Modernization mission, including the production of at least 30 pits per year at LANL; operations support personnel to complete 100% of the SRS mission deliverables including LEP requirements and GTS Surveillance requirements per schedule; and increased safety basis needs at Pantex. The increase is partially offset by a transfer of scope for programmatic equipment maintenance at SNL to the Production Operations program.	**+24,000**
Safety and Environmental Operations: The decrease reflects a small adjustment to reduce uncosted balances, offset by an increase for additional support for the Material Managers at the sites under the Nuclear Materials Integration program.	**-3,354**
Maintenance and Repair of Facilities: The increase supports the Plutonium Modernization mission, including the production of at least 30 pits per year at LANL, increased maintenance needs at SNL to support the MESA ELP, and the transfer of the Waste Solidification Building at the SRS from the Material Management and Minimization's Material Disposition subprogram within DNN. The increase is partially offset by a transfer of scope for programmatic equipment maintenance at KCNSC to the Production Operations program.	**+13,000**
Recapitalization:	
Infrastructure and Safety: The overall decrease reflects a realignment to Mission Enabling Construction to address larger projects. This is partially offset by an increase for planning to support the U1a Complex Access Shaft project at Nevada National Security Site (NNSS) planned for the out years. NNSA is also increasing emphasis on climate resiliency projects within the program.	**-12,054**
Total, Operating	**+21,592**

	FY 2023 Request vs FY 2021 Enacted ($)
Construction	
Mission Enabling Construction: Reflects new starts for the Electrical Power Capacity Upgrade at LANL, Plutonium Modernization Operations & Waste Management Office Building at LANL, and construction for the Special Materials Facility at Y-12. The increase also supports the transition to construction for the Digital Infrastructure Capability Expansion project at LLNL.	**+67,300**
Total, Construction	**+67,300**
Total, Infrastructure and Operations	**+88,892**

Infrastructure and Operations
Operations of Facilities

Description
The Operations of Facilities program provides the funding required to operate NNSA facilities in a safe manner. Operations of Facilities is fundamental to achieving NNSA's plutonium, uranium, tritium, lithium, high explosives, and other mission objectives. It includes essential support such as water and electrical utilities, safety systems, lease agreements for facilities and land, emergency response services, and other critical systems. This program also provides resources for environment, safety, health, and quality (ESH&Q) costs associated with ensuring compliance with Federal, state, and local environmental, worker safety, and health regulations as well as applicable DOE Orders and Directives.

The Operations of Facilities program also funds waste management activities, including treatment, storage, and waste disposition of both hazardous and newly generated radiological wastes. It provides for the daily operations and staffing to ensure facilities, systems, and capabilities are available to meet mission requirements.

The program also supports the Safety Analytics, Forecasting, Evaluation, and Reporting (SAFER) platform that was developed as a data management capability to enable the conversion of currently available data (predominantly narrative reports) into useful information and visualizations for NNSA decision maker support.

FY 2021-FY 2027 site allocations for the Operations of Facilities program are provided in Table 4 below.

Table 4

Site	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Kansas City National Security Campus	107,000	110,000	95,000	101,000	102,000	103,000	104,000
Lawrence Livermore National Laboratory	79,000	80,000	82,000	85,000	86,000	87,000	89,000
Los Alamos National Laboratory	303,000	288,500	325,000	387,000	413,000	420,000	428,000
Nevada National Security Site	102,000	103,000	105,000	121,000	127,000	128,000	129,000
Pantex Plant	75,000	77,000	83,000	84,000	84,000	85,000	87,000
Sandia National Laboratories	125,000	126,000	106,000	112,000	113,000	116,000	116,000
Savannah River Site	92,000	94,000	97,000	104,000	105,000	99,000	99,000
Y-12 National Security Complex	101,000	103,000	104,000	110,000	111,000	137,000	146,000
Headquarters*	30,000	32,500	41,000	40,000	41,000	47,000	52,000
TOTAL	**1,014,000**	**1,014,000**	**1,038,000**	**1,144,000**	**1,182,000**	**1,222,000**	**1,250,000**

* The Operations of Facilities allocation under "Headquarters" includes funding for the Safety Analytics, Forecasting, Evaluation, and Reporting (SAFER) platform and to quickly respond to emergent unforeseeable issues. Funding is distributed to the sites during execution, which is consistent with industry best practices.

Operations of Facilities

Activities and Explanation of Changes

<table>
<tr><th>FY 2021 Enacted</th><th>FY 2023 Request</th><th>Explanation of Changes
FY 2023 Request vs FY 2021 Enacted ($)</th></tr>
<tr><td>Operations of Facilities $1,014,000,000</td><td>Operations of Facilities $1,038,000,000</td><td>Operations of Facilities +$24,000,000</td></tr>
<tr><td>Funding supported base facility operations at:
• Kansas City National Security Campus (KCNSC), supporting non-nuclear production.
• LLNL, supporting plutonium, tritium, and high explosive nuclear security enterprise missions.
• LANL, supporting plutonium production, including pit production, research, and development; chemistry and metallurgy research; weapons engineering and tritium capability; and beryllium operations.
• NNSS, including experimental capabilities.
• Pantex, including industrial and high explosives to support weapon assembly, disassembly, and surveillance in support of the Life Extension Program (LEPs).
• SNL, including environmental testing and microelectronics technologies facilities.
• Savannah River Site (SRS), including tritium and other capabilities.
• Y-12, for enriched and depleted uranium, lithium, and other special material operations.
• Headquarters (HQ), the SAFER platform to support enterprise-wide risk management applications.</td><td>Funding supports base facility operations at:
• KCNSC, supporting non-nuclear production.
• LLNL, supporting plutonium, tritium, and high explosive nuclear security enterprise missions.
• LANL, supporting plutonium production, including pit production, research, and development; chemistry and metallurgy research; weapons engineering and tritium capability; and beryllium operations.
• NNSS, including experimental capabilities.
• Pantex, including industrial and high explosives to support weapon assembly, disassembly, and surveillance in support of the LEPs.
• SNL, including environmental testing and microelectronics technologies facilities.
• SRS, including tritium and other capabilities.
• Y-12, for enriched and depleted uranium, lithium, and other special material operations.
• HQ, the SAFER platform to support enterprise-wide risk management applications.</td><td>• The increase supports: the Plutonium Modernization mission, including the production of at least 30 pits per year at LANL; operations support personnel to complete 100% of the SRS mission deliverables including LEP requirements and GTS Surveillance requirements per schedule; and increased safety basis needs at Pantex. The increase is partially offset by a transfer of scope for programmatic equipment maintenance at SNL to the Production Operations program.</td></tr>
</table>

Infrastructure and Operations
Safety and Environmental Operations

Description

The Safety and Environmental Operations program provides for the Department's Nuclear Criticality Safety Program (NCSP), the NNSA's Nuclear Safety Research and Development (NSR&D) subprogram, Packaging subprogram, Long Term Stewardship (LTS) subprogram, and Nuclear Materials Integration subprogram (NMI). Table 5 provides the funding breakout for these subprograms.

NCSP develops, maintains, and disseminates the essential technical tools, training, and data required to support safe, efficient fissionable material operations within DOE. This includes maintaining and operating the National Criticality Experiments Research Center (NCERC) at NNSS where critical and sub-critical experiments are conducted to provide tests of nuclear data, analytical codes, and to develop new measurement methods.

The NSR&D subprogram provides the technical foundation for safety analyses and controls as well as authorization basis decision making for DOE/NNSA nuclear facilities and associated operations. The NCSP and NSR&D subprograms are vital to ensuring nuclear safety is maintained across the NNSA enterprise.

The Packaging subprogram ensures safe transport of nuclear and radiological materials by providing off-site shipping container research and development, design, certification, recertification, test and evaluation, production and procurement, fielding and maintenance, decontamination, and disposal. It also provides off-site transportation authorization of shipping containers for nuclear materials and components supporting both the nuclear weapons program and nuclear nonproliferation and other mission objectives.

The LTS subprogram ensures environmental safety at remediated sites with residual contamination by conducting activities necessary to meet Federal and state environmental regulatory requirements identified in legally enforceable records of decision, cleanup agreements, and consent orders. The LTS subprogram operates and maintains remediation systems, maintains institutional and engineering controls, and monitors contaminant levels in the soil, groundwater, and surface water. LTS is required to meet environmental requirements associated with corrective actions at sites that are subject to the Resource Conservation and Recovery Act (RCRA) or cleanup requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The LTS program also contributes to the Environmental Justice (J40) program by protecting worker health and the environment on the former Kansas City Plant (including vapor intrusion mitigation within newly constructed buildings) and minimizing the impact of legacy contamination on adjacent properties and surface waters.

The NMI subprogram maintains and operates the Nuclear Materials Management and Safeguards System (NMMSS), which tracks and accounts for nuclear materials at DOE and Nuclear Regulatory Commission-licensed sites, and the Nuclear Materials Inventory Assessment (NMIA) that manages use and demand of accountable nuclear materials by DOE and NNSA laboratories and production plants. In addition, NMI integrates management, consolidates, and coordinates disposal of excess accountable nuclear materials. NMI ensures that both older, unclaimed materials as well as materials currently in use have a viable disposition path. NMI monitors demand and consumption of nuclear materials and identifies future shortages. NMI addresses these potential shortages through focused projects with National Laboratories and educational institutions. NMI collaborates with the counterterrorism and intelligences communities to ensure critical materials are available for the nuclear forensics' community. NMI oversees and stewards nuclear materials managers at DOE/NNSA sites.

Table 5							
Subprogram	**FY 2021 Enacted**	**FY 2022 Annualized CR**	**FY 2023 Request**	**FY 2024 Request**	**FY 2025 Request**	**FY 2026 Request**	**FY 2027 Request**
Nuclear Criticality Safety Program	29,126	29,387	29,080	30,947	31,566	32,197	33,517
Nuclear Safety Research and Development	3,704	3,726	3,418	3,942	4,025	4,109	4,195
Packaging	27,831	25,683	24,986	26,638	26,250	26,477	26,980
Long Term Stewardship	78,283	77,173	75,021	69,973	76,659	75,717	75,717
Nuclear Materials Integration	26,410	29,385	29,495	29,500	28,500	28,500	30,591
TOTAL	**165,354**	**165,354**	**162,000**	**161,000**	**167,000**	**167,000**	**171,000**

Safety and Environmental Operations

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Safety and Environmental Operations $165,354,000	**Safety and Environmental Operations $162,000,000**	**Safety and Environmental Operations -$3,354,000**
Nuclear Criticality Safety Program $29,126,000	**Nuclear Criticality Safety Program $29,080,000**	**Nuclear Criticality Safety Program -$46,000**
• Provided technical infrastructure, expertise, and experimentation capabilities for the DOE encompassing the following technical elements: Nuclear Data, Analytical Methods, Training & Education, Information Preservation and Dissemination, and Integral Experiments. Integral experiments included the NCSP's NCERC to ensure criticality safety capabilities are adequate for the DOE mission.	• Provides technical infrastructure, expertise, and experimentation capabilities for the DOE encompassing the following technical elements: Nuclear Data, Analytical Methods, Training & Education, Information Preservation and Dissemination, and Integral Experiments. Integral experiments included the NCSP's NCERC to ensure criticality safety capabilities are adequate for the DOE mission.	• No significant changes.
Nuclear Safety Research and Development $3,704,000	**Nuclear Safety Research and Development $3,418,000**	**Nuclear Safety Research and Development -$286,000**
• Conducted projects to provide the technical foundation for safety analyses and controls as well as authorization basis decision making for DOE/NNSA nuclear facilities and associated operations.	• Conduct projects to provide the technical foundation for safety analyses and controls as well as authorization basis decision making for DOE/NNSA nuclear facilities and associated operations.	• No significant changes.
Packaging $27,831,000	**Packaging $24,986,000**	**Packaging -$2,845,000**
• Refurbished, reconditioned, maintained, replaced, and certified containers to ensure availability to support the nuclear weapons mission.	• Refurbish, recondition, maintain, replace, and certify containers to ensure availability to support the nuclear weapons mission.	• The decrease reflects a small adjustment to reduce uncosted balances.
Long Term Stewardship $78,283,000	**Long Term Stewardship $75,021,000**	**Long Term Stewardship -$3,262,000**
• Continued to support LTS regulatory required activities at the KC National Security Campus (Bannister site), LLNL (Main Site and Site 300), Pantex Plant, SNL, and Y-12.	• Continue to support LTS regulatory required activities at the KC National Security Campus (Bannister site), LLNL (Main Site and Site 300), Pantex Plant, SNL, and Y-12.	• The decrease reflects a small adjustment to reduce uncosted balances.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
• LTS required activities include: treating contaminated ground water (including the Pantex offsite groundwater contamination plume); monitoring surface/ground water and soils; maintaining landfill remedies; performing CERCLA and RCRA 5-year remedy reviews of selected cleanup remedies; working with the Environmental Protection Agency regions and various states to meet post-completion regulatory cleanup and reporting requirements; addressing potential vapor intrusion studies and remedial activities, and working in concert with other federal agencies, states, and affected stakeholders to execute LTS activities in a cost effective, compliant, and safe manner consistent with end states.	• LTS required activities include: treating contaminated ground water (including the Pantex offsite groundwater contamination plume); monitoring surface/ground water and soils; maintaining landfill remedies; performing CERCLA and RCRA 5-year remedy reviews of selected cleanup remedies; working with the Environmental Protection Agency regions and various states to meet post-completion regulatory cleanup and reporting requirements; addressing potential vapor intrusion studies and remedial activities, and working in concert with other federal agencies, states, and affected stakeholders to execute LTS activities in a cost effective, compliant, and safe manner consistent with end states.	
Nuclear Materials Integration $26,410,000	**Nuclear Materials Integration $29,495,000**	**Nuclear Materials Integration +$3,085,000**
• Maintained and operated the NMMSS for the United States Government. • Processed sodium bonded fuels at Idaho National Laboratory (INL) originally used at SNL. • Planned and implemented activities to recover Pu-244 from the Mk-18a target assemblies at SRS. • Treated, consolidated, and disposed of inactive actinides no longer needed for nuclear security missions at Oak Ridge National Laboratory (ORNL), LANL, and Y-12. • Ensured program direction and management of nuclear materials is effectively executed at each of the site offices. • Provided long-term forecasting, planning and analysis of materials. • Continued to support the emphasis on nuclear material consolidation and de-inventory	• Maintain and operate the NMMSS for the United States Government. • Process sodium bonded fuels at INL originally used at SNL. • Plan and implement activities to recover Pu-244 from the Mk-18a target assemblies at SRS. • Treat, consolidate, and dispose of inactive actinides no longer needed for nuclear security missions at ORNL, LANL, and Y-12. • Ensure program direction and management of nuclear materials is effectively executed at each of the site offices. • Provide long-term forecasting, planning and analysis of materials. • Continue to support the emphasis on nuclear material consolidation and de-inventory activities across the NNSA nuclear security enterprise.	• Increase reflects additional support for the Material Managers at the sites.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
activities across the NNSA nuclear security enterprise. • Continued activities to remove plutonium-bearing mixed oxide fuel.	• Continue activities to remove plutonium-bearing mixed oxide fuel.	

Infrastructure and Operations
Maintenance and Repair of Facilities

Description

The Maintenance and Repair of Facilities program provides direct-funded maintenance activities across the NNSA enterprise for the recurring day-to-day work required to sustain and preserve NNSA facilities and equipment in a condition suitable for their designated purpose. These efforts include predictive, preventive, and corrective maintenance activities to maintain facilities, property, assets, systems, roads, and vital safety systems. This program also funds maintenance of excess facilities (including high-risk excess facilities) necessary to minimize the risk posed by those facilities prior to disposition.

Maintenance and Repair of Facilities is prioritized within an enterprise risk management framework based on mission needs; probability of failure of a system or a component; and risk determination with regard to safety, security, and environmental requirements. Investments focus on those structures, systems, and components that are considered essential to the national security mission. FY 2021-FY 2027 Infrastructure and Operations site allocations for direct-funded maintenance are provided in Table 6 below.

This program also funds the Roof Asset Management Program (RAMP) and the Cooling and Heating Asset Management Program (CHAMP). RAMP provides a dedicated approach to managing roofing assets through a single prioritized list of roofing needs across the nuclear security enterprise. The benefits of this approach enable the implementation of standard industry processes and best practices in the management of the roofing portfolio at a corporate level. Efficiencies are achieved by centralized procurement through leveraged buying power and long-term solutions instead of short-term repairs. The successful RAMP methodology has been expanded to other common components/systems under the Asset Management Program (AMP). Other systems will be analyzed as possible AMPs to achieve additional efficiencies.

Table 6

Site	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Kansas City National Security Campus	28,000	35,000	22,000	21,000	22,000	23,000	28,000
Lawrence Livermore National Laboratory	35,483	35,000	37,000	41,000	41,000	42,000	42,000
Los Alamos National Laboratory	150,000	145,000	156,000	170,000	183,000	192,000	189,000
Nevada National Security Site	58,000	61,000	62,000	65,000	65,000	70,000	70,000
Pantex Plant	117,000	112,000	114,000	115,000	115,000	116,000	118,000
Sandia National Laboratories	19,000	24,000	28,000	32,000	32,000	33,000	33,000
Savannah River Site	40,000	40,000	47,000	49,000	49,000	44,000	45,000
Y-12 National Security Complex	119,000	117,000	119,000	120,000	121,000	122,000	123,000
Enterprise Acquisitions*	100,517	98,000	95,000	98,000	99,000	101,000	103,000
TOTAL	**667,000**	**667,000**	**680,000**	**711,000**	**727,000**	**743,000**	**751,000**

* The Maintenance and Repair of Facilities allocation under “Enterprise Acquisitions” includes funding for Asset Management Programs, which achieve economies of scale and maintenance standardization for critical building systems that are common across the enterprise (e.g. roofs, HVAC) and to quickly respond to emergent unforeseeable issues. Funding is distributed to the sites during execution, which is consistent with industry best practices.

Maintenance and Repair of Facilities

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Maintenance and Repair of Facilities **$667,000,000**	**Maintenance and Repair of Facilities** **$680,000,000**	**Maintenance and Repair of Facilities** **+$13,000,000**
• KCNSC: maintenance of equipment and tenant improvement equipment. • LLNL: maintenance activities at Contained Firing Facility, Superblock, High Explosive Application Facility (HEAF), machine shops, and waste management facilities. • LANL: maintenance activities at Plutonium Facility 4 (PF-4), Chemistry and Metallurgy Research (CMR), Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT), Los Alamos Neutron Science Center (LANSCE), Beryllium, waste management, radiological laboratory, and tritium facilities. • NNSS: funded maintenance of Joint Actinide Shock Physics Experimental Research (JASPER), Big Explosives Experimental Facility (BEEF), Device Assembly Facility (DAF), and U1a. • Pantex: Bays and Cell maintenance, funded emerging requirements, and support high explosives activities. • SNL: maintenance activities at Microsystems Engineering, Science and Applications (MESA), Major Environmental Test Facilities (METF), and Tonopah. • SRS: maintenance on NNSA mission facilities and equipment and activities associated with gas transfer systems. • Y-12: maintenance for uranium and lithium operations. • Enterprise-wide: RAMP and CHAMP centralized procurement activities to increase buying power	• KCNSC: maintenance for Main Campus and Building 23. • LLNL: maintenance activities at Contained Firing Facility, Superblock, HEAF, machine shops, and waste management facilities. • LANL: maintenance activities at PF-4, CMR, DARHT, LANSCE, Beryllium, waste management, radiological laboratory, and tritium facilities. • NNSS: maintenance of JASPER, BEEF, DAF, and U1a. • Pantex: Bays and Cell maintenance, emerging requirements, and support for high explosives activities. • SNL: maintenance activities at MESA, METF, and Tonopah. • SRS: maintenance on NNSA mission facilities and activities associated with gas transfer systems. • Y-12: maintenance for uranium and lithium operations. • Enterprise-wide: RAMP and CHAMP centralized procurement activities to increase buying power and accelerate repairs of systems/components that are common across the NNSA enterprise. • Provides for enterprise-wide activities to stabilize the condition of excess facilities to minimize risk to mission prior to disposition.	• The increase supports the Plutonium Modernization mission, including the production of at least 30 pits per year at LANL, increased maintenance needs at SNL to support the MESA ELP, and transfer of the WSB at the SRS from the Material Management and Minimization's Material Disposition subprogram within DNN. The increase is partially offset by a transfer of scope for programmatic equipment maintenance at KCNSC to the Production Operations program.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
and accelerate repairs of systems/components that are common across the NNSA enterprise. • Provided for enterprise-wide activities to stabilize the condition of excess facilities to minimize risk to mission prior to disposition.		

Infrastructure and Operations
Recapitalization

Description

The Recapitalization program, key to modernizing NNSA infrastructure, prioritizes investments to improve the condition and extend the design life of the structures, capabilities, and/or systems. The Infrastructure and Safety (I&S) subprogram improves the reliability, sustainability, productivity, and efficiency of NNSA's infrastructure to reduce overall operating costs. It also reduces safety, environmental, and program risk associated with facilities and systems that are often well beyond their design life.

The I&S subprogram includes costs for minor construction projects, real property purchases, projects that are expensed, and Other Project Costs (OPC) for mission enabling infrastructure line-item construction projects. I&S also funds deactivation and disposal of excess infrastructure, including stabilization and risk reduction activities at high-risk excess facilities, resulting in surveillance and maintenance cost avoidance and reduced risk to workers, the public, environment, and programs. Recapitalization projects incorporate energy conservation measures to the greatest extent practicable in support of sustainability and energy performance improvements.

NNSA established the Standard Acquisition and Recapitalization (STAR) initiative in May 2019 to develop streamlined, repeatable processes to standardize the design and construction of non-nuclear, low-risk facilities in order to lower cost and accelerate their delivery. Under the STAR initiative, NNSA has a growing library of designs for small office, light laboratory, parking, and fire station facilities that have been successfully built at various NNSA sites. Reusing designs from the library allows NNSA sites to reduce the time spent in design development, saving cost and up to several months in the overall implementation schedule.

NNSA is in the process of working with our Management and Operating (M&O) partners and an Architecture/Engineering firm to draft design standards for administrative buildings that will be common to all sites, similar to the Uniform Facility Criteria used across the Department of Defense. These standards are the predecessors to developing a standard, scalable core building design that will provide the flexibility needed to accommodate needs for new, commercial-like facilities while also simplifying the construction procurement process.

In FY 2023 NNSA is establishing its Energy Resilient Infrastructure and Climate Adaptation (ERICA) initiative as part of a comprehensive infrastructure modernization strategy. ERICA is part of NNSA's multi-faceted approach to address climate adaptation and resilience in direct- and indirect-funded infrastructure programs and alternative financing (i.e., Energy Savings Performance Contracts, Utility Energy Service Contracts, and Utility Service Agreements).

Tables 7 show the plans for Recapitalization projects to be executed with FY 2023 funding based on the status of enterprise infrastructure as of March 2022. This plan may need to be updated before the FY 2023 execution year to respond to changing infrastructure conditions and requirements.

Table 7

Site	Project Name	FY 2023 Allocation ($K)
	National Nuclear Security Administration Infrastructure and Safety Planned FY 2023 Recapitalization Projects - As of March, 2022	
KC	Building 23 Advanced and Exploratory Technologies Area Buildout (Minor Construction)	1,852
	Building Purchase and Expansion Infrastructure Upgrades (Minor Construction)[a]	58,243
	Building 2 Precision Measurement Area Expansion Facility Modifications (Minor Construction) [Design Only]	2,500
Subtotal, Kansas City National Security Campus		**62,595**
LLNL	Building 133 Heating Hot Water System Upgrade (Minor Construction)	7,950
	Building 151 Nuclear and Radiochemistry Facility Dissolver Laboratory Suite Upgrade (Minor Construction)	12,400
	Building 190 CAMS SF6 Transfer Station Upgrade (Minor Construction)	5,800
	Building 331 Tritium Delivery System Upgrade (Minor Construction)	19,450
	Building 850 Upgrade (Minor Construction)	7,000
	Building 131 PH 3091, 3200, 3382 HVAC Replacement [Design Only]	685
	New Site 200 Weapon Activity Warehouse (Minor Construction)	13,950
	Site 200 Electrical Utility Re-distribution System Capacity Upgrade (Minor Construction)	15,025
	Site 200 U295 Water Pumps, Piping, Valves, Controls, Electrical Replacements and Pumphouse Revitalization	3,850
	Site 300 Building 880 Office Space Revitalization (Minor Construction)	3,100
	New Livermore Federal Center Office Building (Minor Construction) [Design Only]	1,000
Subtotal, Lawrence Livermore National Laboratory		**90,210**
LANL	CMR Initial Projects to Prepare for Closure Portfolio	4,000
	LANSCE Building 0003S Electrical Power Distribution Replacement (Minor Construction)	3,698
	LANSCE Fire Suppression Installation Portfolio (Minor Construction)	1,954
	New TA-22 Detonator Storage Magazines (Minor Construction)	9,700
	New TA-63 Fire Station 1 (STAR) (Minor Construction)	22,500
	PF-4 PC-3 Fire Suppression System Seismic Modifications	9,750
	PF-4 Vacuum Services Replacement	11,228
	PF-4 Zone 2 Bleed Off Fans Replacement [Design Only]	1,830
	PF-4 Zone 1 Exhaust Fan Replacement [Design Only]	1,868
	RLWTF Clarifier Number 2 Stabilization [Design Only]	859
	TA-55 Fire Suppression Water Line for Security Facilities (Minor Construction)	9,472
	TA-16-0301 LED Upgrades (ERICA)	400
	TA-16-0304 LED Upgrades (ERICA)	400

[a] Building purchase is not considered a construction activity. The minor construction activities will be under the minor construction threshold.

National Nuclear Security Administration Infrastructure and Safety Planned FY 2023 Recapitalization Projects - As of March, 2022		
Site	**Project Name**	**FY 2023 Allocation ($K)**
	TA-15-0313 LED Upgrades (ERICA)	400
	TA-16-0207 Removal of Steam & Replacement of Electric Heat (ERICA)	1,000
	TA-16-0380 Disposition	4,328
	PHERMEX Firing Point De-inventory Zone 1b & Zone 2	2,400
	TA-08 and TA-11 - 3 High Explosives Facilities Disposition	4,850
Subtotal, Los Alamos National Laboratory		**90,637**
NNSS	New U1a Centralized Monitor and Control Center (Minor Construction)	12,000
NNSS	New DAF Operations Complex Utilities (Minor Construction) [Design Only]	900
NNSS	U1a Fan Equipment Upgrade (Minor Construction)	3,500
NNSS	U1a Fire Detection and Alarm System Revitalization (Minor Construction)	4,050
NNSS	U1a Underground Power Distribution Upgrade (Minor Construction)	11,500
NNSS	Buildings 12-31, 12-7, 23-109, and 23-113 Disposition	2,100
Subtotal, Nevada National Security Site		**34,050**
PX	Bay & Cell RAMS, FDS, & Lead-In Improvements Portfolio	37,000
PX	Building 11-55 Rotoclone System Replacement	9,500
PX	Building 15-34 Pump House and Tank Upgrades (Minor Construction)	6,350
PX	Southeast Circuit Upgrade (Minor Construction)	7,625
PX	Building 04-026 Disposition	2,880
Subtotal, Pantex Plant		**63,355**
SNL	SNL\CA Building C943 Plating Lab Services Upgrade (Minor Construction)	3,000
SNL	SNL\CA Building C964 Generator Upgrade (Minor Construction)	1,500
SNL	SNL\CA Buildings C941/C942 Midloft Air Handler Replacement	5,100
SNL	SNL\CA Building C942 Loft Access Air Handler Upgrade (Minor Construction)	3,300
SNL	SNL\CA Site High Voltage LGS Replacement (Minor Construction) [Design Only]	600
SNL	New Stockpile and Component Modernization Support Building (STAR) (Minor Construction)	15,000
SNL	New TA-II Master Substation (Minor Construction) [Design Only]	1,850
SNL	Building 6530 High Radiation Laboratory Upgrade (AKA LINAC in TA-III) (Minor Construction)	5,400
SNL	Building 6584 HVAC Upgrade (Minor Construction)	2,500
SNL	TA-III, V, & Remotes 5kV Substation Replacement (Minor Construction)	19,500
SNL	TTR Main 13.8 kV Substation and West Feeder Upgrade (Minor Construction)	11,500
SNL	Building 848 Net Zero Energy Upgrade (ERICA) (Minor Construction)	495
SNL	SF6 Reclamation/Emissions Control Upgrade for Buildings 720 and 981 (ERICA) (Minor Construction)	1,660
Subtotal, Sandia National Laboratories		**71,405**

National Nuclear Security Administration Infrastructure and Safety Planned FY 2023 Recapitalization Projects - As of March, 2022		
Site	**Project Name**	**FY 2023 Allocation ($K)**
SRS	Building HANM Fire Protection Upgrades (Minor Construction)	4,858
	HANM Obsolete Oxygen Monitor Replacement Portfolio	3,180
	New Tritium Office Building (STAR), SRFO (Minor Construction)	17,850
Subtotal, Savannah River Site		**25,888**
Y-12	Building 9204-02 Switchgear 810 Replacement (Minor Construction)	4,492
	Building 9212 North Potable and Fire Water Lateral Replacements	8,315
	New West End Production Change House (Minor Construction) [Design Only]	1,284
	Building 9201-03 Single Pass Cooling Unit Upgrades (ERICA)	1,000
	Building 9723-33 Single Pass Cooling Unit Upgrade (ERICA)	500
	Building 9201-5N Single Pass Chuck Vacuum Upgrade (ERICA)	1,000
	Building 9733-05 Potable Water Fixture Upgrades (ERICA)	300
	Elza Switchyard Facility Preparation for Disposition (742-000, 743-000, 1501-01)	2,700
	Building 9204-01 Utility Reroutes	8,200
	9201-05 (Alpha 5) 9021-02 (A2) and Utility Isolations and Reroutes	7,000
Subtotal, Y-12 National Security Complex		**34,791**
	Planning, Assessments, & Infrastructure Management Tools	83,743
	Construction Other Project Costs (OPC)	4,989
Grand Total, Infrastructure and Safety		**561,663**

NNSA implements climate adaptation and resilience improvements throughout its infrastructure modernization portfolio. The projects identified above are those that meet sustainability and reliability performance standards through either targeted investments or larger projects that also address mission and safety risk reduction.

Recapitalization

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Recapitalization $573,717,000	**Recapitalization $561,663,000**	**Recapitalization -$12,054,000**
Infrastructure and Safety $573,717,000	**Infrastructure and Safety $561,663,000**	**Infrastructure and Safety -$12,054,000**
• Provided funds for needed investments in obsolete/aging facilities and infrastructure to improve safety, reliability, and working condition.	• Table 7 contains the current FY 2023 project plan as of March 2022. The table includes advanced funding for design of several complex, high priority projects for future year execution. Recapitalization funds are allocated in accordance with planned priorities but retain the flexibility to adjust efforts to address emerging changes in priorities and unplanned failures.	• The overall decrease reflects a realignment to Mission Enabling Construction to address larger projects. This is partially offset by an increase for planning to support the U1a Complex Access Shaft at NNSS planned for the out years. NNSA is also increasing emphasis on climate resiliency projects within the program.

Infrastructure and Operations
Construction

The Construction subprogram plays a critical role in revitalizing the nuclear security enterprise. Investments from this subprogram will improve the responsiveness and utility of the infrastructure. The subprogram is focused on two primary objectives: (1) identification, planning, and prioritization of the projects supporting national security objectives, and (2) development and execution of these projects within approved cost and schedule baselines. Table 8 shows the breakout of funding by line-item.

Requested FY 2023 funding will support the transition to construction for the Digital Infrastructure Capability Expansion (DICE) project at LLNL. The project will provide the capability to support missions at LLNL with networking and communications services for the next 40 years. The existing networking and communications systems hub in Building 256 is at capacity without room for expansion and must be shut down for maintenance. Digital transmission, or aggregate throughput, demand growth is projected to exceed current capacity.

FY 2023 funding will support the design effort for the Electrical Power Capacity Upgrade project at LANL. The project will increase the LANL electrical transmission system capacity and the LANL distribution system capacity and redundancy. Current transmission/distribution capacity is insufficient to provide stable and reliable power supply essential to all future programmatic missions at LANL.

FY 2023 funding will support the Plutonium Modernization Operations & Waste Management Office Building at LANL. The project will construct an approximately 66,000 square-foot two-story office facility located in Technical Area 63 of the Pajarito Corridor. The facility will provide approximately 300 workstations to enable the following functions: Transuranic and non-Transuranic waste management, packaging, and transportation, waste management support, and nuclear material movement and storage.

FY 2023 funding will also support the Special Materials Facility project at Y-12. The project will repurpose Building 9225-03 to produce new Special Material components in support of the NNSA Defense Programs mission. As documented in the NNSA Special Materials Mission Strategy, the Special Materials Facility will house production and processing equipment required to support current and future mission deliverables. The facility utilities and infrastructure must be modified to complete the manufacturing and production of the Special Material mission.

Table 8

Project	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Mission Enabling Construction							
27-D-XXX, Plutonium Engineering Support Building, LANL	0	0	0	0	0	0	48,700
26-D-XXX, Plutonium Program Accounting Building, LANL	0	0	0	0	0	48,700	0
26-D-XXX, U1a Complex Access Shaft, NNSS	0	0	0	0	0	30,000	85,000
25-D-XXX, Plutonium Mission Safety & Quality Building, LANL	0	0	0	0	48,500	0	0
25-D-XXX, Maintenance Facility, Y-12	0	0	0	0	50,000	0	0
24-D-XXX, Analytic Gas Laboratory, PX	0	0	0	35,000	0	0	0
24-D-XXX, Plutonium Production Building, LANL	0	0	0	48,500	0	0	0

Project	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
23-D-519, Special Material Facility, Y-12	0	0	49,500	0	0	0	0
23-D-518, Plutonium Modernization Operations & Waste Management Office Building, LANL	0	0	48,500	0	0	0	0
23-D-517, Electrical Power Capacity Upgrade, LANL	0	0	24,000	95,000	86,000	79,000	0
22-D-514, Digital Infrastructure Capability Expansion, LLNL	0	8,000	67,300	0	0	0	0
19-D-670, 138kV Power Transmission System Replacement, NNSS	59,000	0	0	0	0	0	0
15-D-612, Emergency Operations Center, LLNL	27,000	0	0	0	0	0	0
15-D-611, Emergency Operations Center, SNL	36,000	0	0	0	0	0	0
Total, Mission Enabling Construction	**122,000**	**8,000**	**189,300**	**178,500**	**184,500**	**157,700**	**133,700**

Construction
Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Mission Enabling Construction $122,000,000	**Mission Enabling Construction $189,300,000**	**Mission Enabling Construction +$67,300,000**
• Started construction of the 138kV Power Transmission System Replacement project at NNSS and the Emergency Operations Centers at LLNL and SNL.	• Transition to construction for the Digital Infrastructure Capability Expansion (DICE) project at LLNL. • Initiate design for the Electrical Power Capacity Upgrade project at LANL. • Initiate the Plutonium Modernization Operations & Waste Management Office Building at LANL. • Initiate Special Materials Facility at Y-12 National Security Complex.	• Reflects a new start for the Electrical Power Capacity Upgrade project at LANL, Plutonium Modernization Operations & Waste Management Office Building at LANL, and construction for the Special Materials Facility at Y-12. Also supports transition to construction for the Digital Infrastructure Capability Expansion project at LLNL.

Infrastructure and Operations
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	0	0	0	0
Minor Construction	N/A	N/A	366,521	299,778	336,307	-30,214
Total, Capital Operating Expenses	N/A	N/A	**366,521**	**299,778**	**336,307**	**-30,214**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Infrastructure and Safety						
Minor Construction Projects (Total Estimated Cost (TEC)						
Total Minor Construction Projects (>$500K and <$5M)	N/A	N/A	31,705	22,168	40,606	+8,901
Building 23 Classified Space Conversion & Electrical Testing, Weld Lab, & Mechanical Assembly Buildout Portfolio, KCNSC	19,119	728	18,391	0	0	-18,391
Building 23 Tool Room & Model Shop Machining Operations Area Expansion Buildout, KCNSC (formerly Building 23 Tool Room & Model Shop Machining Revitalization)	10,042	0	805	9,237	0	-805
Building 23 W80-4 Manufacturing Development Area Buildout, KCNSC	14,700	0	1,712	12,988	0	-1,712
Building 23 W87-1 Manufacturing Development Area Buildout, KCNSC	13,006	0	0	13,006	0	0
New Surface Parking Lot, KCNSC	5,200	375	0	4,825	0	0
Building 23 Advanced and Exploratory Technologies Area Buildout, KCNSC	18,165	0	0	0	1,852	+1,852
Building Purchase and Expansion Infrastructure Upgrades, KCNSC	58,243[a]	0	0	0	58,243	+58,243
Building 321 Chiller Reliability & Safety Exhaust System Redundancy Revitalization, LLNL	9,000	800	8,200	0	0	-8,200
Building 239 & 823 A/B High Energy X-ray Radiography Capability Revitalization, LLNL	8,084	1,334	6,750	0	0	-6,750
New Nondestructive Evaluation Building 310, LLNL	17,100	3,600	13,500	0	0	-13,500

[a] Building purchase is not considered a construction activity.

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Infrastructure and Safety						
Minor Construction Projects (Total Estimated Cost (TEC)						
New Stockpile LEP Office Building 144 (STAR), LLNL (previously New Weapons LEP Office Building, LLNL)	19,400	3,250	16,150	0	0	-16,150
Building 321A Radiological & Material Characterization Capabilities Revitalization, LLNL	11,500	0	1,500	10,000	0	-1,500
Building 832, 834, & 836 Environmental Test & Materials Storage Facilities Upgrades, LLNL	8,200	820	7,380	0	0	-7,380
Building 321 Air Handling Unit & Electrical Upgrades, LLNL	6,400	0	6,400	0	0	-6,400
New Joining Capabilities & Vapor Deposition Facility Building 226 (STAR), LLNL	19,700	0	19,700	0	0	-19,700
Building 132N Variable Air Control Replacement (formerly Building 132N Defense Programs Research Variable Air Control Replacement), LLNL	6,500	0	0	6,500	0	0
New Design & Certification Science Office Facility Building 449 (STAR), LLNL (previously New Building 266 Design & Certification Science Support Office Facility (STAR), LLNL	19,000	1,200	17,800	0	0	-17,800
Site 300 - Zone 3 Water System Upgrades, LLNL (previously Site 300 Water Supply Piping & Valve Zone 3 & Other Upgrades, LLNL)	11,000	0	0	11,000	0	0
Building 191 HEAF Atrium Conversion to Shot-Ready Workspace, LLNL	12,300	0	12,300	0	0	-12,300
New Experimental Science Office Facility Building 266 (STAR), LLNL	22,200	0	0	22,200	0	0
New Livermore Federal Center Office Building, LFO	24,750	0	0	0	1,000	+1,000
New Site 200 Weapon Activity Warehouse, LLNL	13,950	0	0	0	13,950	+13,950
Building 654 Stockpile Science Computing Facility Expansion (previously B654 Expansion, LLNL)	18,900	0	600	18,300	0	-600
Building 190 CAMS SF6 Transfer Station Upgrade, LLNL	5,800	0	0	0	5,800	+5,800
Building 850 Upgrade, LLNL	7,000	0	0	0	7,000	+7,000
Building 133 Heating Hot Water System Upgrade, LLNL	7,950	0	0	0	7,950	+7,950
Site 200 Electrical Utility Re-distribution System Capacity Upgrade, LLNL	15,025	0	0	0	15,025	+15,025
Building 331 Tritium Delivery System Upgrade, LLNL	19,450	0	0	0	19,450	+19,450
Building 151 Nuclear and Radiochemistry Facility Dissolver Laboratory Suite Upgrade, LLNL	12,400	0	0	0	12,400	+12,400

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Infrastructure and Safety						
Minor Construction Projects (Total Estimated Cost (TEC)						
New TA-15 DARHT Hydro Vessel Repair Facility, LANL	16,491	0	2,800	13,691	0	-2,800
PF-4 High Pressure Water Supply Feed Separation, LANL	10,227	0	10,227	0	0	-10,227
TA-15 DARHT Electrical Circuit Upgrade, LANL	13,908	1,968	11,940	0	0	-11,940
PF-4 Power & Communications Systems Upgrade, LANL	16,000	5,287	10,713	0	0	-10,713
New TA-16 Fire Station 5 (SPEAR), LANL	18,600	0	18,600	0	0	-18,600
New TA-15 Flight Instrumentation Test Laboratory (STAR), LANL	19,472	0	19,472	0	0	-19,472
TA-55 Fire Suppression Water Line for Programs Facilities, LANL	13,894	0	0	13,894	0	+0
New TA-22 Detonator Storage Magazines, LANL	11,137	0	0	1,437	9,700	+9,700
TA-55 Fire Suppression Water Line for Security Facilities, LANL	9,472	0	0	0	9,472	+9,472
New TA-63 Fire Station 1 (STAR), LANL	22,500	0	0	0	22,500	+22,500
New TA-03 Weapons Archive Records Facility (WARF), LANL	16,600	0	0	16,600	0	0
New Nevada Site Operations Facility Building 23-461 (formerly New Mercury Building 23- 461), NNSS	19,800	15,000	4,800	0	0	-4,800
New Mercury Mission Technical Support Facility Building 23-462 (Formerly Mercury 23-462 Building 3), NNSS	16,500	0	0	16,500	0	0
New U1a Mission Technical Support Facility, NNSS	16,500	950	15,550	0	0	-15,550
New DAF Operations Complex Site Preparations, NNSS	8,000	0	0	8,000	0	0
New DAF Operations Complex Utilities, NNSS	7,500	0	0	0	900	+900
Area 6 CP Hill to Fire Station Junction Water Line Upgrade, NNSS	5,500	0	0	5,500	0	0
U1a Underground Power Distribution Upgrade, NNSS	13,000	0	0	1,500	11,500	+11,500
New U1a Operations Support Facility 01-380 (STAR), NNSS (previously New U1a Operations Support Facility 01-351 (STAR))	19,500	0	1,400	0	0	-1,400
Tweezer Substation Upgrade, NNSS	11,000	0	0	11,000	0	0

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Infrastructure and Safety						
Minor Construction Projects (Total Estimated Cost (TEC)						
New U1a Centralized Monitor and Control Center, NNSS	12,000	0	0	0	12,000	+12,000
U1a Potable Water System Upgrade, NNSS (Previously U1a Potable & Fire Water System Upgrade, NNSS)	11,700	9,000	2,700	0	0	-2,700
New U1a Sewage Lagoon, NNSS	10,130	4,430	5,700	0	0	-5,700
New Advanced Fabrication Facility, PX	17,000	1,000	16,000	0	0	-16,000
Southeast Circuit Upgrade, PX	7,625	0	0	0	7,625	+7,625
Building 15-34 Pump House and Tank Upgrades, PX	6,350	0	0	0	6,350	+6,350
234-7H Exhaust Ventilation System Installation, SRS	18,413	11,150	0	7,263	0	0
New Tritium Office Building (STAR), SRFO	19,600	0	0	1,750	17,850	+17,850
New Explosives Manufacturing Science & Technology (EMSAT) Facility, SNL	17,500	1,500	16,000	0	0	-16,000
Substation 36 Upgrade, SNL	10,000	0	0	10,000	0	0
Building 6715 Light Initiated High Explosive (LIHE) Test Facility Upgrades, SNL	7,000	750	0	6,250	0	0
TA-I Substation 35 Upgrade, SNL (previously TA-I Substation 35 Replacement)	10,000	0	3,500	6,500	0	-3,500
New TA-II Master Substation, SNL	18,500	0	0	0	1,850	+1,850
SNL\CA Site High Voltage LGS Replacement, SNL	5,700	0	0	0	600	+600
Building 6530 High Radiation Laboratory Upgrade (AKA LINAC in TA-III), SNL	5,400	0	0	0	5,400	+5,400
TA-III, V, & Remotes 5kV Substation Replacement, SNL	19,500	0	0	0	19,500	+19,500
High-G Surveillance Testing Capability Addition (WETL/Pantex), SNL	9,350	350	600	8,400	0	-600
New SNL\CA Limited Area Multi-Program (LAMP) Secure High Bay Laboratory Facility, SNL	19,500	1,900	17,600	0	0	-17,600
TA-IV District Chilled Water Expansion, SNL	18,250	0	1,500	16,750	0	-1,500
TTR Main 13.8 kV Substation & West Feeder Upgrade, SNL	12,000	0	0	500	11,500	+11,500
New Stockpile and Component Modernization Support Building (STAR), SNL	16,400	0	1,400	0	15,000	+13,600
New Geosciences Laboratory-Building 740 (STAR), SNL	18,500	0	18,500	0	0	-18,500
New Building 6534 Radiation Protection Instrumentation Calibration Facility, SNL (previously New Radiation Protection Instrumentation Calibration Facility, SNL)	11,500	9,500	0	2,000	0	0

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Infrastructure and Safety						
Minor Construction Projects (Total Estimated Cost (TEC)						
Building 9204-2E Transformers 814 & 815 Replacement, Y-12	6,560	0	6,560	0	0	-6,560
Development Facility Modifications, Y-12 (formerly Production Development Facility Acquisition and Revitalization Modification), Y-12	24,000	0	12,794	11,206	0	-12,794
Building 9201-05N AJ-5714 HVAC Replacement, Y-12	5,413	0	0	5,413	0	0
New West End Production Change House, Y-12	13,824	0	0	0	1,284	+1,284
Building 9995 198/222 Feeders Electrical Panel Replacement (formerly Building 9995 198/222 Feeders Electrical Panel & Motor Control Center Replacement), Y-12	5,400	0	0	5,400	0	0
Building 9215 North Fire Water Laterals Replacement, Y12	6,329	6,292	37	0	0	-37
Bear Creek Road 13.8kV Electrical Power Distribution Installation, Y-12	13,525	9,740	3,785	0	0	-3,785
3rd St 13.8kV Electrical Power Distribution Installation, Y-12	10,364	8,914	1,450	0	0	-1,450
Total, Minor Construction Projects Infrastructure and Safety	**N/A**	**N/A**	**366,521**	**299,778**	**336,307**	**-30,214**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
	(Dollars in Thousands)				
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))					
Capital Equipment >$500K (including MIE)	0	0	0	0	N/A
Minor Construction	99,053	0	0	0	N/A
Total, Capital Operating Expenses	**99,053**	**0**	**0**	**0**	**N/A**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
	(Dollars in Thousands)				
Infrastructure and Safety					
Minor Construction Projects (Total Estimated Cost (TEC)					
Total Minor Construction Projects (>$500K and <$5M)	0	0	0	0	N/A
Building 23 Advanced and Exploratory Technologies Area Buildout, KCNSC	16,313	0	0	0	0
New Livermore Federal Center Office Building, LFO	23,750	0	0	0	0
New U1a Operations Support Facility 01-380 (STAR), NNSS (previously New U1a Operations Support Facility 01-351 (STAR))	18,100	0	0	0	0
New DAF Operations Complex Utilities, NNSS	6,600	0	0	0	0
New TA-II Master Substation, SNL	16,650	0	0	0	0
SNL\CA Site High Voltage Electrical System LGS Replacement, SNL	5,100	0	0	0	0
New West End Production Change House, Y-12	12,540	0	0	0	0
Total, Minor Construction Projects Infrastructure and Safety	**99,053**	**0**	**0**	**0**	**N/A**

Construction Projects Summary

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
Mission Enabling						
27-D-XXX Plutonium Engineering Support Building, LANL						
TEC	48,700	0	0	0	0	0
OPC	1,300	0	0	0	0	0
TPC, 27-D-XXX Plutonium Engineering Support Building, LANL	**50,000**	**0**	**0**	**0**	**0**	**0**
26-D-XXX Plutonium Program Accounting Building, LANL						
TEC	48,700	0	0	0	0	0
OPC	1,300	0	0	0	0	0
TPC, 26-D-XXX Plutonium Program Accounting Building, LANL	**50,000**	**0**	**0**	**0**	**0**	**0**
26-D-XXX U1a Complex Access Shaft, NNSS						
TEC	115,000	0	0	0	0	0
OPC	4,650	0	0	0	2,200	+2,200
TPC, 26-D-XXX U1a Complex Access Shaft, NNSS	**119,650**	**0**	**0**	**0**	**2,200**	**+2,200**
25-D-XXX Plutonium Mission Safety & Quality Building, LANL						
TEC	48,500	0	0	0	0	0
OPC	1,500	0	0	0	1,300	+1,300
TPC, 25-D-XXX Plutonium Mission Safety & Quality Building, LANL	**50,000**	**0**	**0**	**0**	**1,300**	**+1,300**

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
25-D-XXX Maintenance Facility, Y-12						
TEC	50,000	0	0	0	0	0
OPC	2,110	0	0	0	1,000	+1,000
TPC, 25-D-XXX Maintenance Facility, Y-12	**52,110**	**0**	**0**	**0**	**1,000**	**+1,000**
24-D-XXX Plutonium Production Building, LANL						
TEC	48,500	0	0	0	0	0
OPC	1,500	0	0	1,300	0	-1,300
TPC, 24-D-XXX Plutonium Production Building, LANL	**50,000**	**0**	**0**	**1,300**	**0**	**-1,300**
24-D-XXX Analytic Gas Laboratory, PX						
TEC	35,000	0	0	0	0	0
OPC	1,100	0	0	780	0	-780
TPC, 24-D-XXX Analytic Gas Laboratory, PX	**36,100**	**0**	**0**	**780**	**0**	**-780**
23-D-519 Special Materials Facility, Y-12						
TEC	49,500	0	0	0	49,500	+49,500
OPC	50	0	0	0	0	0
TPC, 23-D-519 Special Materials Facility, Y-12	**49,550**	**0**	**0**	**0**	**49,500**	**+49,500**

	(Dollars in Thousands)					
	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
23-D-518, Plutonium Modernization Operations & Waste Management Office Building, LANL						
TEC	48,500	0	0	0	48,500	+48,500
OPC	1,500	0	175	1,125	0	-1,125
TPC, 23-D-518, Plutonium Modernization Operations & Waste Management Office Building, LANL	**50,000**	**0**	**175**	**1,125**	**48,500**	**+47,375**
23-D-517 Electrical Power Capacity Upgrade, LANL						
TEC	284,000	0	0	0	24,000	+24,000
OPC	9,938	3,654	3,473	0	0	0
TPC, 23-D-517 Electrical Power Capacity Upgrade, LANL	**293,938**	**3,654**	**3,473**	**0**	**24,000**	**+24,000**
22-D-514, Digital Infrastructure Capability Expansion, LLNL						
TEC	75,300	0	0	8,000	67,300	+59,300
OPC	2,700	1,450	256	134	150	+16
TPC, 22-D-514, Digital Infrastructure Capability Expansion, LLNL	**78,000**	**1,450**	**256**	**8,134**	**67,450**	**+59,316**
19-D-670, 138kV Power Transmission System Replacement, NNSS						
TEC	65,000	6,000	59,000	0	0	0
OPC	2,180	2,180	0	0	0	0
TPC, 19-D-670, 138kV Power Transmission System Replacement, NNSS	**67,180**	**8,180**	**59,000**	**0**	**0**	**0**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
18-D-660, Fire Station, Y-12						
TEC	28,000	28,000	0	0	0	0
OPC	4,828	4,828	0	0	0	0
TPC, 18-D-660, Fire Station, Y-12	**32,828**	**32,828**	**0**	**0**	**0**	**0**
17-D-630, Expand Electrical Distribution System, LLNL						
TEC	31,000	31,000	0	0	0	0
OPC	2,800	2,800	0	0	0	0
TPC, 17-D-630, Expand Electrical Distribution System, LLNL	**33,800**	**33,800**	**0**	**0**	**0**	**0**
16-D-515, Albuquerque Complex Project						
TEC	169,000	169,000	0	0	0	0
OPC	5,700	4,055	1,645	0	0	0
TPC, 16-D-515, Albuquerque Complex Project	**174,700**	**173,055**	**1,645**	**0**	**0**	**0**
15-D-613, Emergency Operations Center, Y-12						
TEC	28,919	28,919	0	0	0	0
OPC	4,741	4,741	0	0	0	0
TPC, 15-D-613, Emergency Operations Center, Y-12	**33,660**	**33,660**	**0**	**0**	**0**	**0**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
15-D-612, Emergency Operations Center, LLNL						
TEC	32,000	5,000	27,000	0	0	0
OPC	3,200	2,600	0	600	0	-600
TPC, 15-D-612, Emergency Operations Center, LLNL	**35,200**	**7,600**	**27,000**	**600**	**0**	**-600**
15-D-611, Emergency Operations Center, SNL						
TEC	40,000	4,000	36,000	0	0	0
OPC	2,500	2,161	0	0	339	+339
TPC, 15-D-611, Emergency Operations Center, SNL	**42,500**	**6,161**	**36,000**	**0**	**339**	**+339**
Total, Mission Enabling						
TEC	1,245,619	271,919	122,000	8,000	189,300	+181,300
OPC	53,597	28,469	5,549	3,939	4,989	+1,050
TPC, Mission Enabling	**1,299,216**	**300,388**	**127,549**	**11,939**	**194,289**	**+182,350**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
	(Dollars in Thousands)				
Mission Enabling					
27-D-XXX Plutonium Engineering Support Building, LANL					
TEC	0	0	0	48,700	0
OPC	0	1,100	0	0	200
TPC, 27-D-XXX Plutonium Engineering Support Building, LANL	**0**	**1,100**	**0**	**48,700**	**200**
26-D-XXX Plutonium Program Accounting Building, LANL					
TEC	0	0	48,700	0	0
OPC	1,100	0	0	0	200
TPC, 26-D-XXX Plutonium Program Accounting Building, LANL	**1,100**	**0**	**48,700**	**0**	**200**
26-D-XXX U1a Complex Access Shaft, NNSS					
TEC	0	0	30,000	85,000	0
OPC	800	150	150	150	1,200
TPC, 26-D-XXX U1a Complex Access Shaft, NNSS	**800**	**150**	**30,150**	**85,150**	**1,200**
25-D-XXX Plutonium Mission Safety & Quality Building, LANL					
TEC	0	48,500	0	0	0
OPC	0	0	0	200	0
TPC, 25-D-XXX Plutonium Mission Safety & Quality Building, LANL	**0**	**48,500**	**0**	**200**	**0**
25-D-XXX Maintenance Facility, Y-12					
TEC	0	50,000	0	0	0
OPC	420	120	120	450	0
TPC, 25-D-XXX Maintenance Facility, Y-12	**420**	**50,120**	**120**	**450**	**0**

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
	(Dollars in Thousands)				
24-D-XXX Plutonium Production Building, LANL					
TEC	48,500	0	0	0	0
OPC	0	0	200	0	0
TPC, 24-D-XXX Plutonium Production Building, LANL	**48,500**	**0**	**200**	**0**	**0**
24-D-XXX Analytic Gas Laboratory, PX					
TEC	35,000	0	0	0	0
OPC	0	0	320	0	0
TPC, 24-D-XXX Analytic Gas Laboratory, PX	**35,000**	**0**	**320**	**0**	**0**
23-D-519 Special Materials Facility, Y-12					
TEC	0	0	0	0	0
OPC	50	0	0	0	0
TPC, 23-D-519 Special Materials Facility, Y-12	**50**	**0**	**0**	**0**	**0**
23-D-518, Plutonium Modernization Operations & Waste Management Office Building, LANL					
TEC	0	0	0	0	0
OPC	0	200	0	0	0
TPC, 23-D-518, Plutonium Modernization Operations & Waste Management Office Building, LANL	**0**	**200**	**0**	**0**	**0**
23-D-517 Electrical Power Capacity Upgrade, LANL					
TEC	95,000	86,000	79,000	0	0
OPC	0	0	0	2,811	0
TPC, 23-D-517 Electrical Power Capacity Upgrade, LANL	**95,000**	**86,000**	**79,000**	**2,811**	**0**

	(Dollars in Thousands)				
	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
22-D-514, Digital Infrastructure Capability Expansion, LLNL					
TEC	0	0	0	0	0
OPC	150	560	0	0	0
TPC, 22-D-514, Digital Infrastructure Capability Expansion, LLNL	**150**	**560**	**0**	**0**	**0**
Total, Mission Enabling					
TEC	178,500	184,500	157,700	133,700	0
OPC	2,520	2,130	790	3,611	1,600
TPC, Mission Enabling	**181,020**	**186,630**	**158,490**	**137,311**	**1,600**

23-D-518, Plutonium Modernization Operations & Waste Management Office Building
Los Alamos National Laboratory (LANL), Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2023 request for the Plutonium Modernization Operations & Waste Management (PMOC-1) Office Building is $48,500,000 of Total Estimated Cost (TEC) funding. The current Total Project Cost (TPC) range is $46,000,000 to $50,000,000.

Significant Changes:
This project is a new start in FY 2023.

On October 13, 2017, the Deputy Secretary exempted non-nuclear, non-complex line item construction projects with a TPC less than $50 million from the requirements of the Department of Energy's (DOE) Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, which offered an opportunity to develop a new delivery model for line item projects in the $20M-$50M cost range.

On June 21, 2019, NNSA launched a pilot to streamline the execution of low complexity construction projects using an "Enhanced Minor Construction – Commercial (EMC^2)" approach and following the Deputy Secretary's exemption from DOE Order 413.3B requirements. The pilot implements the FY 2018 National Defense Authorization Act mandate to streamline non-nuclear construction projects less than $100M.

On April 9, 2021, the NNSA Administrator approved expanding the EMC^2 initiative pilot to include this $50 million office building at LANL that supports the Plutonium Modernization mission. The EMC^2 pilot expansion will further advance streamlined acquisition initiatives that increase buying power and accelerate delivery of commercial-like infrastructure. This project is an office building at LANL for additional workforce to enable Plutonium modernization and waste management operations.

The acquisition approach will be a firm fixed price Design-Build contract and will be a standard design and acquisition that can be repeated for delivery of subsequent demands in the near future.

Because this project is not following Order 413.3B, a NNSA Los Alamos Field Office Federal Project Manager (FPM) has been assigned to this project instead of Federal Project Director (FPD).

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	MNS/PRD	Conceptual Design Complete	Performance Baseline	Final Design Complete	Construction Mobilization	D&D Complete	Start Operations
FY 2023	12/14/2021	11/10/2021	2Q FY 2023	3Q FY 2023	4Q FY 2023	N/A	3Q FY 2025

MNS/PRD – Approve Mission Need Statement and Program Requirements Document for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
Performance Baseline – Threshold cost, schedule, and scope commitment
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
Construction Mobilization – First arrival of contractor personnel, equipment, supplies, and/or temporary facilities at the jobsite
D&D Complete – Completion of D&D work
Start Operations – Achievement of project completion and readiness to use the system, facility, or capability

Project Cost History

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2023	4,900	43,600	48,500	1,500	N/A	1,500	50,000

2. Project Scope and Justification

Scope

The project scope is an approximately 66,000-SF two-story office facility located in Technical Area 63 of the Pajarito Corridor. The facility will provide approximately 300 workstations and 21 conference rooms to enable Plutonium Modernization, including the following functions: Transuranic and non-Transuranic waste management, packaging, transportation, and support, and nuclear material movement and storage.

Justification

As documented in LANL's Integrated Strategy for Plutonium Missions at Los Alamos National Laboratory (Los Alamos National Laboratory, LA-CP-20-20372, June 2020), additional workstations are required for employees needing routine access to the Technical Area (TA)-55 complex and other supporting plutonium modernization capabilities in TA-46, 48, 50, and 63. The plutonium missions supported by the additional employees include: Plutonium Modernization (including pit production), Plutonium Surveillance and Science, Plutonium Disposition, Pu-238 Programs, Material Recycle & Recovery, and Americium Oxide Production.

The project is being conducted in accordance with the project management concepts within DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, appendix C, paragraphs 1A-L, but is exempt from the Order. The EMC^2 approach uses minor construction project management processes, industry standard terminology for subcontractor terms and conditions, commercial quality controls, and streamlines Environmental, Safety, and Health while still meeting 10 Code of Federal Regulations Part 851 requirements.

Key Performance Parameters (KPPs)

The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of project completion. The Objective KPPs represent the desired project performance.

KPPs will be finalized at approval of the Performance Baseline.

Key Performance Parameter	Description	Threshold	Objective
KPP-1	Classified Workstation Capacity	A classified workstation to unclassified workstation ratio of 80:20	100% classified workstations
KPP-2	Conference Room Capacity	Conference rooms capable of conducting classified / unclassified Video Teleconferences at 20 net square feet/occupant	Conference rooms capable of conducting classified / unclassified Video Teleconferences at 30 net square feet/occupant

3. Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2023	4,900	4,900	4,900
Total Design	**4,900**	**4,900**	**4,900**
Construction			
FY 2023	43,600	43,600	8,000
FY 2024	0	0	33,400
FY 2025	0	0	2,200
Total Construction	**43,600**	**43,600**	**43,600**
Total Estimated Costs (TEC)			
FY 2023	48,500	48,500	12,900
FY 2024	0	0	33,400
FY 2025	0	0	2,200
Total TEC	**48,500**	**48,500**	**48,500**
Other Project Costs			
FY 2021	175	175	175
FY 2022	1,125	1,125	1,125
FY 2023	0	0	0
FY 2024	0	0	0
FY 2025	200	200	200
Total OPC	**1,500**	**1,500**	**1,500**
Total Project Costs (TPC)			
FY 2021	175	175	175
FY 2022	1,125	1,125	1,125
FY 2023	48,500	48,500	12,900
FY 2024	0	0	33,400
FY 2025	200	200	2,400
Grand Total	**50,000**	**50,000**	**50,000**

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	4,400	0	N/A
Contingency	500	0	N/A
Total, Design	4,900	0	N/A
Construction			
Site Work	3,000	0	N/A
Equipment	0	0	N/A
Construction	36,300	0	N/A
Other, as needed	0	0	N/A
Contingency	4,300	0	N/A
Total, Construction	43,600	0	N/A
Total Estimated Cost	48,500	0	N/A
Contingency, TEC	4,800	0	N/A
Other Project Cost (OPC)			
OPC			
Analysis of Alternatives	0	0	N/A
Conceptual Planning	170	0	N/A
Conceptual Design	1,090	0	N/A
Other OPC Costs	90	0	N/A
Contingency	150	0	N/A
Total, OPC	1,500	0	N/A
Contingency, OPC	150	0	N/A
Total Project Cost	50,000		N/A
Total Contingency (TEC+OPC)	4,950		N/A

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Outyears	Total
FY 2023	TEC	0	0	48,500	0	0	0	0	0	48,500
	OPC	175	1,125	0	0	200	0	0	0	1,500
	TPC	175	1,125	48,500	0	200	0	0	0	50,000

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	3Q FY 2025
Expected Useful Life (number of years)	40
Expected Future Start of D&D of this capital asset (fiscal quarter)	3Q FY 2065

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	--	1.55	--	74.9

7. D&D Information

The new area being constructed in this project is not replacing existing facilities. LANL will D&D an offsetting amount of space in accordance with their current facility plan.

	Square Feet
New area being constructed by this project at LANL	66,000
Area of D&D in this project at LANL	NA
Area at LANL to be transferred, sold, and/or D&D outside the project, including area previously "banked"	66,000
Area of D&D in this project at other sites	NA

8. Acquisition Approach

The acquisition approach is a firm fixed price Design-Build contract managed by the LANL Management & Operating contractor.

23-D-517, Electrical Power Capacity Upgrade
Los Alamos National Laboratory (LANL), Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Electrical Power Capacity Upgrade (EPCU) Project is $24,000,000 for construction design scope. The project will resolve projected future shortfalls in the electrical transmission and distribution system at Los Alamos National Laboratory (LANL). The Class III total project cost (TPC) is $238,830,840 with a range of $214,947,756 to $298,538,550 (-10% to +25% using AACE range). A conceptual design is complete and is consistent with the Analysis of Alternatives. This conceptual design will support a planned CD-1 in 2022.

Significant Changes

This project is a new start in FY 2023. The following is a history of the effort to this point in time.

- The EPCU Project received CD-0 in August 2018, approval of Mission Need Statement and Project Requirements Document, with a TPC range of $110 million to $300 million and a CD-4 of 4Q FY 2024. The current CD-4 estimate is 1Q FY 2028. The initial preferred alternative could not be pursued, resulting in further analysis to determine the next best option and a delayed request for funding. A Level III Federal Project Director (FPD) has been assigned to the project.
- NNSA's Office of Cost Estimating and Program Evaluation (CEPE) issued a sufficiency memorandum on December 19, 2019 indicating the Analysis of Alternatives fully met all of the 22 GAO's best practices and GAO's 12-step cost estimating process.
- A NEPA Strategy has been approved and determined a preparation of an environmental assessment is the appropriate level of NEPA documentation.
- July 2020, Submitted Standard Form 299 *Application For Transportation, Utility Systems, Telecommunications And Facilities On Federal Lands And Property* (SF 299) to adjacent federal land owners.

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2023	8/24/2018	8/18/2021	4Q FY2022	2Q FY2024	4Q FY2024	3Q FY2024	N/A	1Q FY2028

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History

(Dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2023	24,000	260,000	284,000	9,938	N/A	9,938	293,938[a]

2. Project Scope and Justification

Scope

In support of LANL's mission growth, the EPCU project will improve the electrical power capacity for the Laboratory as it will allow load growth from 116 MVA (existing limit) up to a minimum of 200 MVA (future limit). Improvements include a new 115 KV import transmission line as well as one on-site line approximately 4.5 miles long, upgrades for three 115 KV/13.8 KV substations, addition of medium-voltage, underground, substation inter-tie circuits and switch gear, and addition of medium-voltage feeder circuits and switch gear to increase power capacity to support 60 MW for strategic computing platforms at LANL.

Justification

The mission of the project is to resolve the projected future shortfalls in the Laboratory's electrical transmission and distribution system to ensure it can reliably support the power demands from all programs performing work at LANL while maintaining compliance with applicable FERC/NERC requirements for utility operations. The site will exceed peak power demand for the Norton Line (NL), which is one of two main 115kV transmission lines that feeds power to LANL. The NL is forecasted to exceed its operating limit within the 2025/2026 timeframe without operational constraint. LANL anticipates an increase in power demands across several mission areas including: integrated nuclear programs, science & technology experiments, and infrastructure re-investment over the next ten years. While most of this demand growth is temporally distributed, growth in high-performance computing for large computing platforms is a key schedule driver.
Without sufficient electrical capacity and capability, the Department of Energy's (DOE) and National Nuclear Security Administration's (NNSA) core mission pillars at LANL will be compromised.

The funds appropriated under this data sheet may be used for contracted support services to the Federal Program Manager and the FPD to conduct independent assessments of the planning and execution of this project required by DOE O 413.3B and to conduct technical reviews of design and construction documents. The project is being conducted in accordance with the project management requirements in DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. As allowed by DOE O 413.3B, work will be phased to improve overall efficiency.

Key Performance Parameters (KPPs)

Key Performance Parameters (KPPs) were established at CD-0. The KPPs consider minimum import capacity, power system reliability, distribution capacity to serve Strategic Computing Center, and service restoration. Achievement of the Threshold KPPs is a prerequisite for approval of CD-4, *Project Completion*.

[a] Estimated TPC is within the Class III estimated cost range. The estimate will be updated as the project matures and Critical Decisions are reached.

Performance Measure	Threshold	Objective
Power redundancy	T1 - Provide a minimum capacity of 200 MVA 100% redundancy†, N-1, for all off-site* and on-site§ transmission at 115 kV.	O1a - Provide 234 MVA capacity 100% redundancy†, N-1, for all off-site* and on-site§ transmission lines at 115 kV. O1b - Provide 266 MVA Capacity 100% redundancy†, N-1, for all off-site* and on-site§ transmission lines at 115 kV.
Power distribution	T2 - N-2, for substation transformers and substation interties and, N-1, for the balance of feeder circuits. (For example: If a long lead item fails (*e.g.,* a distribution duct or transformer) the system will still operate while allowing maintenance or failure of a second major component.)	O2a – Provide active Volt-amp-reactive (VAR) devices support on key distribution circuits (voltage support). O2b – Provide additional substation interties to increase operational flexibility. O2c – Provide on-site storage to reduce peak demand and provide VAR power.
Power capacity	T3 – Provide 60 MVA capacity distribution feeder circuits and switchgear to SCC.	O3 – Provide 80 MVA capacity distribution feeder circuits and switchgear to SCC.
Power availability	T4 – Service restoration within 8 hours when operating at less than N-1.	O4 - No major service disruptions.

† N-1: N-1 contingency allows one major transmission asset to be out of service and still serve all loads.

‡ N-2: N-2 contingency allows two major distribution assets to be out of service at one time, planned or unplanned, and still serve all loads. Major distribution asset is a substation transformer or substation distribution tie circuit.

*** Off-site**: off-site transmission refers to transmission lines that connect to the bulk electric system.

§ On-site: on-site transmission refers to the internal transmission lines that connect NNSA substations and switching stations.

3. Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2023	24,000	24,000	15,000
FY 2024	0	0	9,000
Total Design	**24,000**	**24,000**	**24,000**
Construction			
FY 2024	95,000	95,000	45,000
FY 2025	86,000	86,000	75,000
FY 2026	79,000	79,000	75,000
FY 2027	0	0	65,000
Total Construction	**260,000**	**260,000**	**260,000**
Total Estimated Costs (TEC)			
FY 2023	24,000	24,000	15,000
FY 2024	95,000	95,000	54,000
FY 2025	86,000	86,000	75,000
FY 2026	79,000	79,000	75,000
FY 2027	0	0	65,000
Total TEC	**284,000**	**284,000**	**284,000**
Other Project Costs			
FY 2019	1,038	1,038	355
FY 2020	2,616	2,616	1,958
FY 2021	3,473	3,473	2,784
FY 2022	0	0	1,000
FY 2023	0	0	150
FY 2024	0	0	150
FY 2025	0	0	150
FY 2026	0	0	150
FY 2027	2,811	2,811	1,920
FY 2028	0	0	1,321
Total OPC	**9,938**	**9,938**	**9,938**
Total Project Costs (TPC)			
FY 2019	1,038	1,038	355
FY 2020	2,616	2,616	1,958
FY 2021	3,473	3,473	2,784
FY 2022	0	0	1,000
FY 2023	24,000	24,000	15,150
FY 2024	95,000	95,000	54,150
FY 2025	86,000	86,000	75,150
FY 2026	79,000	79,000	75,150

	Budget Authority (Appropriations)	Obligations	Costs
FY 2027	2,811	2,811	66,920
FY 2028	0	0	1,321
Grand Total	**293,938**	**293,938**	**293,938**

4. **Details of Project Cost Estimate**

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	20,200		N/A
Contingency	3,800	-	N/A
Total, Design	24,000	-	N/A
Construction			
Site Work	0		N/A
Equipment[a]	0		N/A
Construction	220,350		N/A
Federal Construction Support	0		N/A
Contingency	39,650		N/A
Total, Construction	260,000		N/A
Total Estimated Cost	284,000		N/A
Contingency, TEC	43,450		N/A
Other Project Cost (OPC)			
OPC			
Analysis of Alternatives	0		N/A
Conceptual Design	2,790		N/A
Start-up	1,000		N/A
Other Project Costs	5,786		N/A
Contingency	362		N/A
Total, OPC	9,938		N/A

[a] Equipment such as insulators, switchgear, transformers, etc. are included in the construction costs.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Contingency, OPC	362		N/A
Total Project Cost	293,938		N/A
Total Contingency (TEC+OPC)	43,812		N/A

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Outyears	Total
FY 2023	TEC	0	24,000	95,000	86,000	79,000	0	0	284,000
	OPC	7,127	0	0	0	0	2,811	0	9,938
	TPC	7,127	24,000	95,000	86,000	79,000	2,811	0	293,938

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	1Q FY 2028
Expected Useful Life (number of years)	45
Expected Future Start of D&D of this capital asset (fiscal quarter)	1Q FY 2073

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	N/A	3.54	N/A	159.3

7. D&D Information

There is no new area being constructed in this construction project. This scope of this project does not include adding any floor space to an existing facility.

8. Acquisition Approach

The Project will be managed and construction executed by the LANL Management and Operating (M&O) contractor, which in turn will subcontract the design/build construction work using a Fixed Price best value procurement subcontract.

22-D-514, Digital Infrastructure Capability Expansion
Lawrence Livermore National Laboratory (LLNL), Livermore, California
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary:
The FY 2023 Request for the Digital Infrastructure Capability Expansion (DICE) is $67,300,000 of Total Estimated Cost (TEC) funding to start construction. The DICE project is a design-build project. The most recent Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, was approved on December 16, 2021, by the Associate Administrator of Safety, Infrastructure, and Operations. The CD-1 approved total project cost range is $52,000,000 to $78,000,000 with a projected CD-4 of 4Q FY 2025.

An experienced Federal Project Director was assigned, Oct 2020, post CD-0.

Significant Changes:
An Independent Project Review was performed for CD-1 that challenged the scope necessary to achieve the KPPs. The review resulted in a need for significantly more mechanical and electrical equipment, as well as a larger facility than was accounted for in the LLNL Conceptual Design estimate. This caused both a correction in the KPP requirements and the cost estimate for the new KPPs. The Power Availability Key Performance Parameter (KPP) threshold and objective values have been reduced to reflect larger amounts of acceptable network downtime, ranging from 22 hours per year to 1.6 hours per year.

The final design complete milestone has been delayed to 1Q FY 2024 and the projected CD-4 milestone has been delayed to 2Q FY 2026 due to additional time required to solicit and award the design-build contract, as well as a longer-than-assumed continuing resolution in FY 2022.

Critical Milestone History

Table 1: Parent Project Critical Milestone History by Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2022	7/9/2020	4/7/2021	4Q FY2021	4Q FY2022	4Q FY2022	4Q FY2022	N/A	4Q FY2025
FY 2023	7/9/2020	4/7/2021	12/16/2021	1Q FY2023	1Q FY2024	1Q FY2023	N/A	2Q FY2026

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History

Table 2: Parent Project Financial Data (Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2022	8,000	60,000	68,000	1,900	N/A	1,900	69,900
FY 2023	8,000	67,300	75,300	2,700	N/A	2,700	78,000

2. Project Scope and Justification

Scope

An approximately 13,000 square foot, one-story facility with a basement vault and adjacent service yard, including equipment for approximately 35 new Information Technology (IT) / Telecommunication equipment racks. The basement vault is for connection to the existing LLNL campus fiber and copper infrastructure that is then routed up into the building for distribution and termination. The service yard will house facility electrical and mechanical equipment. Although the building will initially be furnished with approximately 35 new IT/Telecommunication equipment racks, additional space and services for expansion of up to 80 equipment racks will be provided to accommodate future growth for the 40-year facility life.

Justification

The existing networking and communications systems hub in Building 256 (B256) is at capacity without room for expansion. Digital transmission, or aggregate throughput, demand growth has exceeded B256's capacity requiring programs to coordinate activities to work around the current capacity. Key assets such as the National Ignition Facility (NIF), Life Extension Programs (LEPs), and High-Performance Computing activities would experience operational disruption if the facility's capacity is not expanded. An essential network capability upgrade scheduled for 2027 will put the entire network and site at risk of power outages or overheating, potentially resulting in loss of digital communications.

The project is being conducted in accordance with the project management requirements in Department of Energy Order (DOE O) 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction.

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

In accordance with DOE O 413.3B, KPPs will be finalized at approval of CD-2, *Approve Performance Baseline*.

Performance Measure	Threshold	Objective
Digital Capacity	1,900 Gigabytes per second (Gbps) with Expansion Capability to 3,700 Gbps	2,000 Gbps with Expansion Capability to 4,000 Gbps
Power Availability	99.749%	99.982%

3. Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2022	8,000	8,000	1,300
FY 2023	0	0	4,700
FY 2024	0	0	2,000
Total Design	**8,000**	**8,000**	**8,000**
Construction			
FY 2023	67,300	67,300	2,400
FY 2024	0	0	28,800
FY 2025	0	0	28,900
FY 2026	0	0	7,200
Total Construction	**67,300**	**67,300**	**67,300**
Total Estimated Costs (TEC)			
FY 2022	8,000	8,000	1,300
FY 2023	67,300	67,300	7,100
FY 2024	0	0	30,800
FY 2025	0	0	28,900
FY 2026	0	0	7,200
Total TEC	**75,300**	**75,300**	**75,300**
Other Project Costs			
FY 2020	1,450	1,450	170
FY 2021	256	256	1,330
FY 2022	134	134	150
FY 2023	150	150	150
FY 2024	150	150	150
FY 2025	560	560	500
FY 2026	0	0	250
Total OPC	**2,700**	**2,700**	**2,700**
Total Project Costs (TPC)			
FY 2020	1,450	1,450	170
FY 2021	256	256	1,330
FY 2022	8,134	8,134	1,450
FY 2023	67,450	67,450	7,250
FY 2024	150	150	30,950
FY 2025	560	560	29,400
FY 2026	0	0	7,450
Grand Total	**78,000**	**78,000**	**78,000**

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	6,000	6,000	N/A
Contingency	2,000	2,000	N/A
Total, Design	8,000	8,000	N/A
Construction			
Site Work	4,500	4,000	N/A
Equipment	24,500	22,000	N/A
Construction	29,000	22,500	N/A
Other, as needed	0	0	N/A
Contingency	9,300	11,500	N/A
Total, Construction	67,300	60,000	N/A
Total Estimated Cost	75,300	68,000	N/A
Contingency, TEC	11,300	13,500	N/A
Other Project Cost (OPC)			
OPC			
Analysis of Alternatives	0	0	N/A
Conceptual Planning	170	170	N/A
Conceptual Design	1,330[a]	1,370	N/A
Other OPC Costs	1,200	360	N/A
Contingency	0	0	N/A
Total, OPC	2,700	1,900	N/A
Contingency, OPC	0	0	N/A
Total Project Cost	78,000	69,900	N/A
Total Contingency (TEC+OPC)	11,300	13,500	N/A

[a] Amount updated to reflect actual costs after billing was completed.

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Outyears	Total
FY 2022	TEC	0	8,000	0	0	0	0	0	60,000	68,000
	OPC	1,540	90	0	0	0	0	0	270	1,900
	TPC	1,540	8,090	0	0	0	0	0	60,270	69,900
FY 2023	TEC	0	8,000	67,300	0	0	0	0	0	75,300
	OPC	1,706	134	150	150	560	0	0	0	2,700
	TPC	1,706	8,134	67,450	150	560	0	0	0	78,000

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	2Q FY 2026
Expected Useful Life (number of years)	40
Expected Future Start of D&D of this capital asset (fiscal quarter)	2Q FY 2066

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	6.22	6.22	274.1	274.1

7. D&D Information

The new area being constructed in this project is not replacing existing facilities. LLNL will D&D an offsetting amount of space in accordance with its current facility plan.

	Square Feet
New area being constructed by this project at LLNL	13,000
Area of D&D in this project at LLNL	NA
Area at LLNL to be transferred, sold, and/or D&D outside the project, including area previously "banked"	13,000
Area of D&D in this project at other sites	NA
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	NA
Total area eliminated	13,000

8. Acquisition Approach

The acquisition approach will be Design-Build managed through the M&O. The subcontract for design and construction will be a firm fixed price and managed in accordance with DOE O 413.3B.

23-D-519, Special Materials Facility Project
Y-12 National Security Complex, Oak Ridge, Tennessee
Project is for Construction Only

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2023 Request for the Special Materials Facility (SMF) Project is $49,500,000 Total Estimated Cost (TEC) for construction for the SMF Utilities and Infrastructure Construction Only Subproject. The current Total Project Cost (TPC) range for the overall project is $51,400,000 to $62,200,000.

Significant Changes:
This project is a new start in FY 2023. This project's overall scope was originally planned as three individual activities that have been combined into a Line Item with two subprojects.

The first subproject, Building 9225-03 Equipment Removal, began executing as a minor construction project in FY 2021 and is almost complete. As project planning progressed on the other two activities, NNSA determined the overall scope of the three projects should be combined into one Line Item project, as the related efforts were over the minor construction threshold to address the same overall mission need.

The Building 9225-03 Equipment Removal Subproject was notified as a minor construction project in the FY 2021 congressional budget justification, started work in FY 2021, and is forecast to be complete by June 2022.

A portion of the SMF Utilities and Infrastructure Construction Only Subproject scope was previously notified as the Y-12 Building 9225-03 Special Materials Program Electrical Upgrades minor construction project in FY 2021, but had not started work.

The remaining scope was previously planned as non-construction activities for execution in FY 2023; however, upon further planning development, it was determined that the scope contained construction activities. That scope was combined with the minor construction project scope to form the second subproject, SMF Utilities and Infrastructure Construction Only, under this Line Item.

The design for the SMF Utilities and Infrastructure Construction Only Subproject is being executed as a separate minor construction project under $5,000,000 and is forecast to be complete by December 2022. The costs associated with design are not included in the Construction Only project request.

Regarding the SMF Utilities and Infrastructure Construction Only Subproject:
- On October 13, 2017, the Deputy Secretary exempted non-nuclear, non-complex line item construction projects with a TPC less than or equal to $50 million from the requirements of the Department of Energy's (DOE) Order 413.3B, which offered an opportunity to develop a new delivery model for line item projects in the $20 million to $50 million cost range.
- On June 21, 2019, NNSA launched a pilot to streamline the execution of low complexity construction projects using an "Enhanced Minor Construction – Commercial (EMC^2)" approach and following DOE Order 413.3B's exemption from requirements.
- The SMF Utilities and Infrastructure Construction Only Subproject will implement the FY 2018 National Defense Authorization Act mandate to streamline non-nuclear construction projects less than $100 million by implementing the EMC^2 approach and using the exemption for construction projects with a TPC less than or equal to $50 million from Order 413.3B.

A Level II Federal Project Director has been assigned to this project.

Critical Milestone History

Fiscal Quarter or Date

Overall Project

Fiscal Year	MNS/PRD	Conceptual Design Complete	Performance Baseline	Final Design Complete	Construction Mobilization	D&D Complete	Start Operations
FY 2023	N/A	3/10/2022	3Q FY 2023	1Q FY 2023	4Q FY 2023	N/A	3Q FY 2025

Building 9225-03 Equipment Removal Subproject

Fiscal Year	MNS/PRD	Conceptual Design Complete	Performance Baseline	Final Design Complete	Construction Mobilization	D&D Complete	Start Operations
FY 2023	N/A	8/13/2020	N/A	N/A	2/1/2021	N/A	3Q FY 2022[a]

SMF Utilities and Infrastructure Construction Only Subproject

Fiscal Year	MNS/PRD	Conceptual Design Complete	Performance Baseline	Final Design Complete	Construction Mobilization	D&D Complete	Start Operations
FY 2023	N/A	3/10/2022	3Q FY 2023	1Q FY 2023[a]	4Q FY 2023	N/A	3Q FY 2025

MNS/PRD – Approve Mission Need Statement and Program Requirements Document for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
Performance Baseline – Threshold cost, schedule, and scope commitment
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
Construction Mobilization – First arrival of contractor personnel, equipment, supplies, and/or temporary facilities at the jobsite
D&D Complete – Completion of D&D work
Start Operations – Achievement of project completion and readiness to use the system, facility, or capability

Project Cost History

(Dollars in Thousands)

Overall Project

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2023	0	61,700	61,700	500	0	500	62,200

Equipment Removal Subproject (Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2023	0	12,200	12,200	0	0	0	12,200

[a] Projected to be achieved in June, 2022.

SMF Utilities and Infrastructure Construction Subproject (Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2023	0	49,500	49,500	500	0	500	50,000

2. Project Scope and Justification

<u>Scope</u>

The existing Building 9225-03 is being repurposed for a new Special Material component manufacturing mission in support of the NNSA Defense Programs. Approximately 6,400 square feet of interior space will be remodeled to hold new process equipment. The scope of work includes removal of legacy hazardous waste materials, demolition and disposal of legacy process equipment, upgrading the building's electrical and mechanical services, providing new inert gas utility services, tenant finishes, and installation of equipment pads.

Building 9225-03 Equipment Removal Subproject: This subproject's scope is removal of legacy hazardous waste materials and demolition and disposal of legacy process equipment, including gloveboxes, piping, and tanks. This project was funded in FY 2021 under the Uranium Modernization program and will complete in FY 2022.

SMF Utilities and Infrastructure Construction Subproject: This subproject's scope is upgrading the building's electrical and mechanical services, providing new inert gas utility services, tenant finishes, and installation of equipment pads.

<u>Justification and Mission Need</u>

In the late 2000's, the NNSA discontinued the legacy process used to produce certain nuclear weapon components due to safety concerns. This project prepares Building 9225-03 to host equipment which will be used to restore the capability to produce these components using new manufacturing techniques. These components are required to meet Program of Record mission deliverables to the Department of Defense.

The project is being conducted in accordance with the project management concepts within DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, appendix C, paragraphs 1A-L, yet is exempt from the Order. The EMC^2 approach uses Minor Construction project management processes, industry standard terminology for subcontractor terms and conditions, commercial quality controls, and streamlines Environmental, Safety, and Health while still meeting 10 Code of Federal Regulations Part 851 requirements.

<u>Key Performance Parameters (KPPs)</u>

The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of project completion. The Objective KPPs represent the desired project performance.

KPPs will be finalized at approval of the Performance Baseline.

Key Performance Parameters

Key Performance Parameter	Description	Threshold	Objective
KPP-1	Utility Services	All service requirements refer to that crossing the building envelope from the external supply. Electrical: 480 Volt, 3-phase, 2400kVA Compressed air: 2” diameter pipe Argon: 3” diameter pipe Helium: 3” diameter pipe Nitrogen: 3” diameter pipe Supply Air: 21,000 CFM Exhaust Air: 21,000 CFM Chiller water: 2” diameter pipe Cooling water: 5” diameter pipe	All service requirements refer to that crossing the building envelope from the external supply. Electrical: 480 Volt, 3-phase, 3600kVA Compressed air: 2” diameter pipe Argon: 3” diameter pipe Helium: 3” diameter pipe Nitrogen: 3” diameter pipe Supply Air: 21,000 CFM Exhaust Air: 21,000 CFM Chiller water: 2” diameter pipe Cooling water: 5” diameter pipe
KPP-2	Humidity-Control	Humidity-Control: 40% relative humidity	Humidity-Control: 40% relative humidity

3. Financial Schedule

Total Project

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2021	12,200	12,200	7,500
FY 2022	0	0	4,700
FY 2023	49,500	49,500	7,500
FY 2024	0	0	29,700
FY 2025	0	0	12,300
Total Construction	**61,700**	**61,700**	**61,700**
Total Estimated Costs (TEC)			
FY 2021	12,200	12,200	7,500
FY 2022	0	0	4,700
FY 2023	49,500	49,500	7,500
FY 2024	0	0	29,700
FY 2025	0	0	12,300
Total TEC	**61,700**	**61,700**	**61,700**
Other Project Costs			
FY 2025	500	500	500
Total OPC	**500**	**500**	**500**
Total Project Costs (TPC)			
FY 2021	12,200	12,200	7,500

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	0	0	4,700
FY 2023	49,500	49,500	7,500
FY 2024	0	0	29,700
FY 2025	500	500	12,800
Grand Total	**62,200**	**62,200**	**62,200**

Building 9225-03 Equipment Removal Subproject

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2021	12,200	12,200	7,500
FY 2022	0	0	4,700
Total Construction	**12,200**	**12,200**	**12,200**
Total Estimated Costs (TEC)			
FY 2021	12,200	12,200	7,500
FY 2022	0	0	4,700
Total TEC	**12,200**	**12,200**	**12,200**
Other Project Costs			
FY 2021	0	0	0
FY 2022	0	0	0
Total OPC	**0**	**0**	**0**
Total Project Costs (TPC)			
FY 2021	12,200	12,200	7,500
FY 2022	0	0	4,700
Grand Total	**12,200**	**12,200**	**12,200**

SMF Utilities and Infrastructure Construction Subproject

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2023	49,500	49,500	7,500
FY 2024	0	0	29,700
FY 2025	0	0	12,300
Total Construction	**49,500**	**49,500**	**49,500**
Total Estimated Costs (TEC)			
FY 2023	49,500	49,500	7,500
FY 2024	0	0	29,700
FY 2025	0	0	12,300
Total TEC	**49,500**	**49,500**	**49,500**
Other Project Costs			
FY 2025	500	500	500
Total OPC	**500**	**500**	**500**
Total Project Costs (TPC)			
FY 2023	49,500	49,500	7,500
FY 2024	0	0	29,700
FY 2025	500	500	12,800
Grand Total	**50,000**	**50,000**	**50,000**

4. Details of Project Cost Estimate

Total Project (Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Construction			
Site Work	2,000	N/A	N/A
Equipment	0	N/A	N/A
Construction	48,900	N/A	N/A
Other, as needed	0	N/A	N/A
Contingency	10,800	N/A	N/A
Total, Construction	61,700	N/A	N/A
Total Estimated Cost	61,700	N/A	N/A
Contingency, TEC	10,800	N/A	N/A
Other Project Cost (OPC)			
OPC			

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Analysis of Alternatives	0	N/A	N/A
Conceptual Planning	0	N/A	N/A
Conceptual Design	0	N/A	N/A
Other OPC Costs	500	N/A	N/A
Contingency	0	N/A	N/A
Total, OPC	500	N/A	N/A
Contingency, OPC	0	N/A	N/A
Total Project Cost	62,200	N/A	N/A
Total Contingency (TEC+OPC)	10,800	N/A	N/A

Building 9225-03 Equipment Removal Subproject

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Construction			
Site Work	0	N/A	N/A
Construction	12,200	N/A	N/A
Other, as needed	0	N/A	N/A
Contingency	0	N/A	N/A
Total, Construction	12,200	N/A	N/A
Total Estimated Cost	12,200	N/A	N/A
Contingency, TEC	0	N/A	N/A
Other Project Cost (OPC)			
OPC			
Analysis of Alternatives	0	N/A	N/A
Conceptual Planning	0	N/A	N/A
Conceptual Design	0	N/A	N/A
Other OPC Costs	0	N/A	N/A
Contingency	0	N/A	N/A
Total, OPC	0	N/A	N/A
Contingency, OPC	0	N/A	N/A
Total Project Cost	12,200	N/A	N/A
Total Contingency (TEC+OPC)	0	N/A	N/A

SMF Utilities and Infrastructure Construction Subproject

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Construction			
Site Work	2,000	N/A	N/A
Equipment	0	N/A	N/A
Construction	36,700	N/A	N/A
Other, as needed	0	N/A	N/A
Contingency	10,800	N/A	N/A
Total, Construction	49,500	N/A	N/A
Total Estimated Cost	49,500	N/A	N/A
Contingency, TEC	10,800	N/A	N/A
Other Project Cost (OPC)			
OPC			
Analysis of Alternatives	0	N/A	N/A
Conceptual Planning	0	N/A	N/A
Conceptual Design	0	N/A	N/A
Other OPC Costs	500	N/A	N/A
Contingency	0	N/A	N/A
Total, OPC	500	N/A	N/A
Contingency, OPC	0	N/A	N/A
Total Project Cost	50,000	N/A	N/A
Total Contingency (TEC+OPC)	10,800	N/A	N/A

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	Outyears	Total
FY 2023	TEC	12,200	0	49,500	0	0	0	0	0	61,700
	OPC	0	0	0	0	500	0	0	0	500
	TPC	12,200	0	49,500	0	500	0	0	0	62,200

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	3Q FY 2025
Expected Useful Life	25 years
Expected Future Start of D&D of this capital asset	3Q FY 2050

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	--	0.528	--	13.5

7. D&D Information

There is no new area being constructed in this construction project.

	Square Feet
New area being constructed by this project at Y-12	N/A
Area of D&D in this project at Y-12	N/A
Area at Y-12 to be transferred, sold, and/or D&D outside the project, including area previously "banked"	N/A
Area of D&D in this project at other sites	N/A
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	N/A
Total area eliminated	N/A

8. Acquisition Approach

The acquisition approach is Design-Bid-Build using firm fixed price contracts managed by the Y-12 Management & Operating contractor.

Secure Transportation Asset

Overview

The Secure Transportation Asset (STA) provides safe, secure transport of the Nation's nuclear weapons, weapon components, and special nuclear material throughout the nuclear security enterprise to meet nuclear security requirements and support the broader National Nuclear Security Administration (NNSA) and Department of Energy (DOE) operations. Nuclear weapon life-extension programs, limited-life component exchanges, surveillance, dismantlement, nonproliferation activities, and experimental programs rely on safe, secure, and on-schedule transport of STA cargos.

The STA program includes the Operations and Equipment (OPS) and Program Direction (PD) subprograms. The OPS subprogram provides the STA's transportation service infrastructure required to meet NNSA's nuclear security activities as outlined in the Fiscal Year (FY) 2023 Stockpile Stewardship and Management Plan. The PD subprogram provides salaries, travel, and other related expenses in support of Federal Agents (FA) and the secure transportation workforce.

STA currently has the mission capacity to meet NNSA stockpile sustainment priorities, strategic material and component transfers, and other DOE workloads. STA will continue to balance and prioritize customer requests against capacity. Since its establishment in 1974, STA has maintained its legacy of safety and security to include no loss of cargo and no radiological release on any shipment.

The FY 2023 Budget Request of $344,437,000 is 1.2 percent below the FY 2021 Enacted level. The request supports modernization and sustainment of STA transportation assets, including life extension of the Safeguards Transporter (SGT) until replaced by the Mobile Guardian Transporter (MGT). The first MGT Production Unit is planned for completion in FY 2026 and will begin a phased in approach beginning in FY 2027. The funding provides for replacement of convoy support vehicles and tractors, sustainment of the infrastructure, command and control system platforms, and minor construction projects. The FY 2023 PD budget provides for 572 Federal Full Time Equivalents (FTEs). STA is focused on recruiting, stabilizing, training, and retaining the FA and staff workforce. The STA budget funds 11 support service contracts of approximately 395 personnel assisting in several areas encompassing aviation, administration, information technology, facility maintenance, intelligence, and engineering.

Secure Transportation Asset
Funding

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Secure Transportation Asset					
Operations and Equipment	225,000	225,000	214,367	-10,633	**-4.7%**
Program Direction	123,684	123,684	130,070	+6,386	+5.2%
Total, Secure Transportation Asset	**348,684**	**348,684**	**344,437**	**-4,247**	**-1.2%**
Federal FTEs	**552**	**574**	**572**	**+20**	**+3.6%**

Secure Transportation Asset
Funding

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Secure Transportation Asset					
Operations and Equipment					
Mission Capacity	87,187	87,187	57,628	-29,559	**-33.9%**
Security/Safety Capability	23,135	23,135	24,954	+1,819	**+7.9%**
Infrastructure and C5 Systems	32,942	32,942	29,816	-3,126	**-9.5%**
Program Management	8,247	8,247	9,034	+787	**+9.5%**
Mobile Guardian Transporter	73,489	73,489	92,935	+19,446	**+26.5%**
Total Operations and Equipment	**225,000**	**225,000**	**214,367**	**-10,633**	-4.7%
Program Direction					
Salaries and Benefits	100,605	100,605	100,214	-391	**-0.4%**
Travel	6,807	6,807	7,081	+274	**+4.0%**
Other Related Expenses	16,272	16,272	22,775	+6,503	**+40.0%**
Total, Program Direction	**123,684**	**123,684**	**130,070**	**+6,386**	**+5.2%**
Total, Secure Transportation Asset	**348,684**	**348,684**	**344,437**	**-4,247**	**-1.2%**
Federal FTEs - Program Direction Funded	**552**	**574**	**572**	**+20**	**+3.6%**

Secure Transportation Asset
Outyear Funding

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Secure Transportation Asset				
Operations and Equipment	222,412	245,709	250,873	301,145
Program Direction	132,264	135,264	138,100	140,996
Total, Secure Transportation Asset	**354,676**	**380,973**	**388,973**	**442,141**
Federal FTEs	**579**	**584**	**590**	**588**

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Secure Transportation Asset				
Operations and Equipment				
Mission Capacity	60,500	59,714	63,550	109,884
Security/Safety Capability	23,353	23,846	24,348	24,863
Infrastructure and C5 Systems	30,705	30,122	30,805	31,452
Program Management	8,888	8,808	8,951	9,139
Mobile Guardian Transporter	98,966	123,219	123,219	125,807
Total Operations and Equipment	**222,412**	**245,709**	**250,873**	**301,145**
Program Direction				
Salaries and Benefits	101,939	103,616	106,337	108,237
Travel	6,884	7,366	7,161	7,670
Other Related Expenses	23,441	24,282	24,602	25,089
Total, Program Direction	**132,264**	**135,264**	**138,100**	**140,996**
Total, Secure Transportation Asset	**354,676**	**380,973**	**388,973**	**442,141**

Secure Transportation Asset
Explanation of Major Changes
(Dollars in Thousands)

	FY 2023 Request vs FY 2021 Enacted ($)
Secure Transportation Asset (STA)	
Operations and Equipment:	**-10,633**
The decrease reflects the aircraft procurement in FY 2021 and a transfer ($3.8M) from OPS to PD to support two support service contracts (Advanced Management Strategies Group and a portion of the Project Enhancement Corporation) consisting of 28 employees (analysis to align with appropriate fund definition). These decreases are partially offset by increased funding for MGT scheduled deliverables including continued development of Engineering Releases, continued Pre-Production Unit (PPU) stage builds, validation of the PPU manufacturing process, and perform Test Article 2 (TA2) Crash Test.	
Program Direction:	**+6,386**
The FY 2023 budget provides salaries and benefits, travel, and other related expenses for FA and the secure transportation workforce. The projected FTEs for FY 2023 is 572 which will be accomplished by holding three Nuclear Material Courier Basic (NMCB) courses (projections are calculated using pay period methodology in A-11 Section 85.5(c) and consider NMCB candidates, attrition, risk, projected workload, and the ability to maintain the safety and security of mission-related requirements to fully support the NSE). Support reflects two support service contracts (Advanced Management Strategies Group and a portion of the Project Enhancement Corporation) consisting of 28 employees ($3.8M) previously funded in OPS (analysis to align with appropriate fund definition) and inflation. STA plans in accordance with projected workload, ability to maintain the safety and security of the mission-related requirements imposed on the workforce to fully support the NSE. COVID-19 impacts resulted in carryover which will be used to support PD requirements.	
Total, Secure Transportation Asset	**-4,247**

Secure Transportation Asset
Operations and Equipment

Description

The Operations and Equipment (OPS) subprogram includes providing unit training FAs, specialized vehicles (such as highly secure trailers), and robust communications systems. Within the STA OPS subprogram, five activities make unique contributions to the safety and security of the nuclear stockpile. These activities accomplish the following:

(1) Mission Capacity – provides mission-essential agent equipment, maintenance, modification and replacement of the transportation fleet, and aviation services.
(2) Security/Safety Capability - NMCB training to increase the FA workforce, develops and implements new fleet technologies, executes agent sustainment training, implements Security, Safety, and Emergency Response programs, and provides uniforms or allowances for uniforms, as authorized by 5 U.S.C. 5901-5902.
(3) Infrastructure and Command and Control, Communication, Computer and Cyber (C5) Systems - provides support for maintenance and minor construction projects and C5 systems.
(4) Program Management - provides corporate functions and business operations that control, assist, and direct secure transport operations.
(5) Mobile Guardian Transporter (MGT) – allows for the design, development, testing, and fabrication of the MGT.

Mission Capacity

Sustains STA systems through equipment purchases to fulfill transportation requirements. Asset maintenance is critical to support current and future missions. Current assets include agent equipment, vehicles (tractors, trailers, and escort vehicles), and aircraft. Modernizing and sustaining these assets requires an integrated, long-term strategy and substantial investment. STA's strategy includes retiring outdated assets, refurbishing existing assets to extend their useful life, and procuring new assets with increased capabilities to meet our customers ever changing needs and evolving threats. STA's efforts include:

- Replacement of the vehicle fleet with new-vehicles which includes the design, engineering, testing, and fielding of specialized vehicles, tractors, and trailers necessary for successful convoy operations.
- Continue the aviation program, to include maintenance and sustainment of STA's aircraft fleet ensuring availability and reliability for mission operations.
- Sustain the required readiness posture of the STA fleet.

Security/Safety Capability

Sustains STA systems capacity through security and safety upgrades. This includes the following activities:

- Identify, design, and test new fleet and mission technologies. Deliverables include safety and security upgrades as well as enhancements to the secure trailers, data analysis, information dissemination, and usage of emerging physical security technology.
- Conduct NMCB classes to increase agent end-strength through training and equipping FA candidates with the best products and tools available.
- Sustain specialized FA skills and qualifications by providing technical equipment, logistics, curriculum development, and staffing necessary to conduct Special Response Force training, Operational Readiness Training (ORT), Validation Force-on-Force (VFoF) exercises, and Agent Sustainment Training. Sustainment Training includes surveillance detection, tactics, advanced driving skills, and firearm education. In addition, funding supports contracts for mission operation support and off-site training venues capable of supporting unit or FA commands during training activities.
- Maintain security and safety programs by conducting liaison activities with state and local law enforcement organizations, analysis of security methods and equipment, vulnerability assessments, development of Safeguards and Security Plans and combat simulation computer modeling. Furthermore, validation of needed safety and security measures, execution of safety studies recommendations and review of engineering analysis results, execution of Nuclear Explosive Safety protocols and risk reduction of over-the-road safety issues.
- Maintain the Emergency Operations Center and the Transportation and Emergency Control Center in Albuquerque, New Mexico and train and exercise the STA emergency response capability. Includes the Emergency Management Program, FA Incident Command System refresher, and sustainment training.

- Evaluate, test, and determine the viability of unmanned systems for use in the STA mission to conduct safe and secure operations.

Infrastructure and Command, and Control, Communication, Computer, and Cyber (C5)
Sustains the system platforms operated by STA. These systems provide critical information obtained, analyzed, and disseminated prior to the mission. Includes continuous monitoring of all data guaranteeing it is accurate/valid and constant communication within convoys, between convoys and headquarters to ensure mission success. These activities must be accomplished in real-time while balancing cyber security requirements and reliability and integrity. Additionally, STA leverages other systems technology supporting business processes and operations which improve efficiency and effectiveness of STA. This funding supports the following sub-elements:

- Modernize and sustain C5 systems activities to maintain vigilant oversight of nuclear convoys. Operate the Transportation Emergency Control Centers (TECC) and maintain the New Mexico Relay Station, as well as maintain communications systems across the STA.
- Maintain and expand the Mission Management System, a secure unclassified to classified controlled interface. This allows communications from unclassified to classified systems, and maintenance and enhancement of a common operating picture for the TECC as well as convoys.
- Expand, upgrade, and maintain the STA facilities and equipment in support of mission requirements. STA is minimizing operational safety and health risks by addressing deferred maintenance. Facilities include FA commands, vehicle mechanical and electronic maintenance shops, training command, and support staff buildings. Activities to sustain these facilities include maintenance and minor construction projects.

Program Management
Creates a well-managed, responsive, and accountable organization by employing effective business practices for the STA program. This activity includes:

- Corporate functions such as technical document support and business processes that control, assist, and direct secure transport operations (includes supplies, equipment, and regulation control procedures).
- Assess, evaluate, and improve functions and processes including self-assessments, configuration management, quality assurance program, and business integration activities.

Mobile Guardian Transporter (MGT)
Provides for the design, production, and testing of the MGT which is the replacement for the existing SGT. The MGT will assure the safety and security of cargo and containers, protect the public, meet nuclear explosive safety requirements associated with accident scenarios, reduce the risk to security threats, and provide for enhanced communications. This includes the following activities:

- Test Article (TA) Assembly and Testing
- Mechanical Systems Development
- Electronics and Auxiliary Systems Development
- Active Delay System Development
- Enhanced Cargo Restraint Development

Highlights of the FY 2023 Budget Request
The FY 2023 Request includes the development, design, production, and maintenance of specialized mission vehicles, tractors, trailers, escort vehicles, trained FAs, and robust communications systems.

FY 2023 Funding Specifically Supports:
- Development of Engineering Releases, continued PPU stage builds, validation of the PPU manufacturing process, and perform TA2 Crash Test for the MGT.
- Production of the Next Generation Armored Tractor (T4) and Escort Vehicle (EV4) as a replacement for the current armored tractor and escort vehicle.

- Life extension and risk reduction activities for the aging SGT to ensure the fleet continues to meet the Nuclear Explosive Safety Study requirements associated with transporting nuclear weapons and components until the MGT is fully deployed.
- Maintenance of existing facilities required by DOE Order 430.1C and minor construction projects of new and existing facilities.
- Steady state replacement of vehicles and tractors.

FY 2024 – FY 2027 Key Milestones

- Delivery of MGT First Production Unit (FPU) in FY 2026.
- Aircraft procurement in FY 2027.

FY 2021 Accomplishments

- Completed over 108 weapon/special nuclear materials shipments and made over 62 limited-life component deliveries without incident.
- Completed Boeing 737 aircraft procurement (replacing DC-9).
- MGT:
    - Completed the Baseline Design Review.
    - Released TA1 timeline and testing results.
    - Released initial drawings for design testers.
    - Initiated build of the qualification and production testers.
    - Commenced product specification releases to the Production Agency.
- Completed design for Agent Operations Western Command building (to replace temporary building).
- Completed build of the Live Fire Shoot House at STA's Training Command in Fort Smith, Arkansas.

Operations and Equipment

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Operations and Equipment $225,000,000	**Operations and Equipment $214,367,000**	**Operations and Equipment -$10,633,000**
Mission Capacity $87,187,000	**Mission Capacity $57,628,000**	**Mission Capacity -$29,559,000**
• Refurbished 6 Escort Vehicles and Escort Vehicle Light Chassis vehicles. • Began redesign of the Tractor Control Unit (TCU). • Supported risk reduction initiatives for sustainment of the SGT until MGT is fully integrated into mission operations. Includes Air Stream development work to customize and qualify designs for legacy and future systems. • Procured a B-737 aircraft to replace the DC-9.	• Production of 8 to 10 next generation EV4 vehicles and 3 to 4 next generation (T4) units. • Vehicle sustainment efforts to continue redesign of the TCU. • Supports risk reduction initiatives for sustainment of the SGT until MGT is fully integrated into mission operations.	• Completion of aircraft procurement in FY 2021. • Provide inflationary increase to continue mission operations.
Security/Safety Capability $23,135,000	**Security/Safety Capability $24,954,000**	**Security/Safety Capability +$1,819,000**
• Conducted two NMCB courses. • Conducted an ORT and VFoF exercise. • Conducted Security Site Survey and Staff Assistance Visits. • Continued National Incident Management System/Incident Command System training program for FAs and staff.	• Equipment and services to support NMCB courses. • Conduct an ORT exercise and VFoF exercise. • Conduct annual Security Site Survey and Staff Assistance Visits. • Conduct the National Incident Management System/Incident Command System training program for FAs and staff. • Replacement of two Logistical Support Trailers critical for mobile training storage.	• Replacement of two Logistical Support Trailers critical for mobile training storage.
Infrastructure and C5 Systems $32,942,000	**Infrastructure and C5 Systems $29,816,000**	**Infrastructure and C5 Systems -$3,126,000**
• Conducted maintenance and minor construction projects at the FA commands, training facility, and STA Headquarters (HQ) to include a new shipping and receiving facility and running track at Agent Operations Eastern Command and Vehicle Maintenance Facility at Agent Operations Western Command. • Continued implementation and maintenance of applications and systems that interconnect	• Conduct maintenance and minor construction projects at the FA commands, training facility, and STA HQs, including build of the Vehicle Maintenance Facility at Agent Operations Central Command in Amarillo, Texas. • Continue implementation and maintenance of applications and systems that interconnect communications with STA vehicles and the TECC.	• Reduction reflects progress in procurement of modular and mobile communications equipment.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
communications with STA vehicles and the TECC. • Supported advanced cyber threat intelligence capabilities and integrate awareness into mission operations.	• Support advanced cyber threat intelligence capabilities and integrate awareness into mission operations.	
Program Management $8,247,000	**Program Management $9,034,000**	**Program Management +$787,000**
• Executed program with approximately 25 full-time support service contractors that provide acquisitions and program support. • Conducted Quality Assurance assessments. • Continued corporate business services and integration activities.	• Conduct Quality Assurance assessments. • Continue corporate business services and integration activities.	• Contract renewal for support service contract and increase in requirements to support quality assessments and technical documents resulting from delayed work (COVID-19).
Mobile Guardian Transporter $73,489,000	**Mobile Guardian Transporter $92,935,000**	**Mobile Guardian Transporter +$19,446,000**
• Began build of the qualification and production testers. • Released product specifications to the production agency. • Performed TA2 Phase 1 Qualification Tests.	• Continue Development of Engineering Releases. • Continue PPU stage builds. • Start initial Advanced Engineering Release. • Validate PPU manufacturing processes. • Complete TA2 Crash Test.	• Increased work and resources required to support the continued Development of Engineering Releases, PPU stage builds, initial Advanced Engineering Release, validation of PPU manufacturing processes, and complete TA2 Crash Test.

Secure Transportation Asset
Program Direction

Description

The Secure Transportation Asset (STA) Program Direction subprogram provides personnel ensuring the safety and security of the nuclear stockpile. The total planned Full Time Equivalents (FTE) supports the Federal Agent (FA) force, Federal pilots, emergency management plans/activities, security and safety programs, and other key elements of the STA mission. STA is committed to a stable human resources strategy to achieve an optimal agent force to meet the National Nuclear Security Administration (NNSA) nuclear security enterprise priorities and mission requirements. The optimal FA force is determined by analysis of the projected workload and the resources required to support the NSE weapon modernization and production schedule. STA continues to execute Nuclear Material Courier Basic (NMCB) courses to sustain current manning and ensuring mission capacity.

Salaries and Benefits

Provides for the program staff located at Albuquerque, New Mexico; Fort Chaffee, Arkansas; and Washington, District of Columbia; and for FAs and support staff at three FA force locations in Albuquerque, New Mexico; Oak Ridge, Tennessee; and Amarillo, Texas. Funding is for salaries, overtime, worker's compensation, and health/retirement benefits associated with FAs, secondary positions, and support staff. Allocations account for an average vacancy rate over the fiscal year and may not match actual on-board FTEs at any time.

Travel

Travel funds utilized for secure convoys, training at military installations and other facilities, and program oversight.

Other Related Expenses

Provides required certification training for the handling of nuclear materials by FAs as well as staff and FA professional development. It maintains the Human Reliability Program (HRP) for FAs and designated staff, provides for Energy Information Technology (IT) Services/DOE Common Operating Environment (EITS/DOECOE), and other contractual service requirements, to include facility maintenance.

Highlights of the FY 2023 Budget Request

The FY 2023 PD Budget Request supports FA and staff FTEs for STA mission execution and priorities. This includes:

- Support for 572 FTEs (accounts for vacancies).
- Travel to support mission and training requirements.
- EITS/DOECOE fees.
- Professional development training.
- Funding for support service contracts.

FY 2024 – FY 2027 Key Milestones

- Continue to support FA and staff FTEs, travel for mission and training requirements, EITS/DOECOE fees and service support contracts.

FY 2021 Accomplishments

- Graduated 24 new FAs.
- Continued to support mission operations through COVID-19 pandemic.

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Program Direction $123,684,000	**Program Direction $130,070,000**	**Program Direction +$6,386,000**
Salaries and Benefits $100,605,000	**Salaries and Benefits $100,214,000**	**Salaries and Benefits -$391,000**
• Recruited, hired, and retained quality personnel based on current and future mission needs. • Continued to fill agent vacancies to support workload requirements. • Increased Workers' Compensation costs due to non-mission accident (2018). • Conducted two NMCB courses. STA plans to increase class size in future NMCB courses to meet the FA workforce target.	• Recruit, hire, and retain quality personnel based on current and future mission needs. • Fill FA and staff vacancies to sustain workload requirements. Supports 572 FTEs. • Conduct three NMCB courses (projections consider gains from NMCB and losses due to mandatory retirements and attrition).	• Carryover used to support requirements (COVID-19 impacts). • Workers' Compensation return to steady state.
Travel $6,807,000	**Travel $7,081,000**	**Travel +$274,000**
• Traveled required to transport nuclear weapons, components, and special nuclear material. • Funded to support travel to facilities that provide unique training to maintain agent skill sets. • Supported charter plane service (unavailability of STA aircraft due to maintenance and/or other mission support).	• Travel required to transport nuclear weapons, components, and special nuclear material. • Funding to support travel to facilities that provide unique training to maintain agent skill sets. • Charter plane contract funded biennially as a contingency plan to support requirements when current STA aircraft is unavailable.	• Charter plane contract funded biennially as a contingency plan to support requirements when current STA aircraft is unavailable.
Other Related Expenses $16,272,000	**Other Related Expenses $22,775,000**	**Other Related Expenses +$6,503,000**
• Continued medical evaluations of individuals assigned to HRP duties and medical training for STA FA medics. • Supported NMCB candidate training at the Federal Law Enforcement Training Center. • Supported processing of security clearances. • Supported EITS/DOECOE costs.	• Continuous medical evaluations of individuals assigned to HRP duties and additional medical training for STA FA medics. • Support NMCB candidate training at the Federal Law Enforcement Training Center. • Support for mandatory ethics/integrity training for new STA employees. • Support processing of security clearances. • Support EITS/DOECOE costs. • Support service contracts for facility maintenance, intelligence analysts, and other	• New HRP contract resulted in additional costs. • EITS/DOECOE increases at 5% per year. • Reflects transfer of support service contract costs (from STA OPS to PD to align with purpose of funding).

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
	administrative staff at multiple STA sites in Albuquerque and Arkansas.	

Secure Transportation Asset
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	43,015	5,483	5,483	-37,532
Minor Construction	N/A	N/A	2,861	32,945	23,700	+20,839
Total, Capital Operating Expenses	**N/A**	**N/A**	**45,876**	**38,428**	**29,183**	**-16,693**
Capital Equipment > $500K (including MIE)						
Total Non-MIE Capital Equipment (>$500K and <$5M)	N/A	N/A	1,588	5,483	5,483	+3,895
Replacement Aircraft (DC-9)	41,427	0	41,427	0	0	-41,427
Mobile Guardian Transporter	34,000	0	0	0	0	0
Replacement Aircraft (Lifecycle Replacement 737)	45,000	0	0	0	0	0
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**43,015**	**5,483**	**5,483**	**-37,532**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Minor Construction Projects (Total Estimated Cost (TEC)						
Total Minor Construction Projects (TEC <$5M)	N/A	N/A	1,412	8,145	7,500	+6,088
Agents Operation Western Command Facility	14,606	13,157	1,449	0	0	-1,449
Agent Operations Central Command Infrastructure and Master Plan	5,000	0	0	5,000	0	0
Vehicle Maintenance Facility – Agent Operation Western Command VMF	18,000	0	0	18,000	0	0
Vehicle Maintenance Facility – Agent Operations Central Command VMF	18,000	0	0	1,800	16,200	+16,200
Total, Minor Construction Projects	**N/A**	**N/A**	**2,861**	**32,945**	**23,700**	**+20,839**
Total, Capital Summary	**N/A**	**N/A**	**45,876**	**38,428**	**29,183**	**-16,693**

Secure Transportation Asset
Outyear Capital Summary

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))					
Capital Equipment >$500K (including MIE)	5,483	5,483	13,983	75,983	N/A
Minor Construction	7,500	7,500	7,500	7,500	N/A
Total, Capital Operating Expenses	**12,983**	**12,983**	**21,483**	**83,483**	**N/A**
Capital Equipment > $500K (including MIE)					
Total Non-MIE Capital Equipment (>$500K and <$5M)	5,483	5,483	5,483	5,483	N/A
Mobile Guardian Transporter	0	0	8,500	25,500	0
Replacement Aircraft (Lifecycle Replacement 737)	0	0	0	45,000	0
Total, Capital Equipment (including MIE)	**5,483**	**5,483**	**13,983**	**75,983**	**N/A**

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
Minor Construction Projects (Total Estimated Cost (TEC)					
Total Minor Construction Projects (TEC <$5M)	7,500	7,500	7,500	7,500	N/A
Total, Minor Construction Projects	**7,500**	**7,500**	**7,500**	**7,500**	**N/A**
Total, Capital Summary	**12,983**	**12,983**	**21,483**	**83,483**	**N/A**

Defense Nuclear Security

Overview

The Office of Defense Nuclear Security (DNS) leads, develops, and implements the National Nuclear Security Administration's (NNSA) security program to enable NNSA's nuclear security enterprise (NSE) missions. DNS provides protection for NNSA personnel, facilities, nuclear weapons, and materials from a full spectrum of threats, ranging from minor security incidents to acts of terrorism, at its national laboratories, production plants, processing facilities, and the Nevada National Security Site (NNSS). In addition, DNS provides nuclear security expertise for a broad set of evolving national security needs, in line with its core mission, such as those in defense nuclear nonproliferation, homeland security, and intelligence. Employing more than 1,700 Protective Force officers, DNS secures more than 5,000 buildings and protects more than 52,000 personnel.

Defense Nuclear Security
Funding

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Defense Nuclear Security					
Operations and Maintenance					
Protective Forces	410,770	410,770	465,546	+54,776	+13.3%
Physical Security Systems	127,035	127,035	169,369	+42,334	+33.3%
Information Security	51,860	51,860	61,831	+9,971	+19.2%
Personnel Security	45,790	45,790	52,743	+6,953	+15.2%
Material Control and Accountability	31,690	31,690	45,581	+13,891	+43.8%
Security Program Operations and Planning	95,933	95,933	83,293	-12,640	-13.2%
Total, Operations and Maintenance	**763,078**	**763,078**	**878,363**	**+115,285**	**+15.1%**
Construction	26,000	26,000	3,928	-22,072	-84.9%
Total, Defense Nuclear Security	**789,078**	**789,078**	**882,291**	**+93,213**	**+11.8%**

Defense Nuclear Security
Outyear Funding

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Defense Nuclear Security				
Operations and Maintenance				
Protective Forces	517,584	533,758	542,411	569,367
Physical Security Systems	150,984	164,247	177,663	196,955
Information Security	62,696	66,224	68,250	69,964
Personnel Security	55,425	58,129	59,216	60,810
Material Control and Accountability	49,850	52,286	53,364	54,388
Security Program Operations and Planning	91,024	80,670	90,623	97,704
Total, Operations and Maintenance	**927,563**	**955,314**	**991,527**	**1,049,188**
Total, Defense Nuclear Security	**927,563**	**955,314**	**991,527**	**1,049,188**

Defense Nuclear Security
Explanation of Major Changes
(Dollars in Thousands)

	FY 2023 Request vs FY 2021 Enacted ($)
Defense Nuclear Security	
Operations and Maintenance: The increase is based on additional security requirements associated with mission growth across the NNSA NSE, including plutonium pit production and preparation for operation of the Uranium Processing Facility (UPF). In addition, funding supports increased security requirements related to Design Basis Threat (DBT) implementation and sustaining Core Security requirements, inclusive of built-in cost escalation increases created by Collective Bargaining Agreements, notably within Protective Forces. The increase also reflects support for the Caerus security system and support for the highest priority Security Infrastructure Revitalization Program (SIRP) projects, as well as highest priority initiatives for the Physical Security Center of Excellence (PSCOE) and the Center for Security Technology, Analysis, Response, and Testing (CSTART).	**+115,285**
Construction: This decrease reflects progress towards completion of construction for 17-D-710, the West End Protected Area Reduction (WEPAR) project, which will reduce the size of the Protected Area while integrating with the UPF, as well as reductions in government contingency and contractor management reserve in the associated project plan.	**-22,072**
Total, Defense Nuclear Security	**+93,213**

Defense Nuclear Security
Budget Request Highlights and Future Milestones

Highlights of the Fiscal Year 2023 Budget Request

The Fiscal Year (FY) 2023 Budget Request of $882,291,000 reflects an increase of $93,213,000, or 11.8% above the FY 2021 Enacted level for Defense Nuclear Security. The budget request includes funding to add positions in key security program areas required to support implementation of a risk-based, layered protection strategy at the sites. These areas include protective forces, physical security systems, information security, technical security, personnel security, nuclear material control and accountability, and security program operations and planning. The budget request supports refined security requirements associated with DBT policy implementation and known mission growth across the NSE, including support for FY 2023 requirements for plutonium pit production at Los Alamos National Laboratory (LANL) and to hire, clear, and train appropriate personnel in time to support planned UPF project milestones, inclusive of Operational Readiness Reviews, which are necessary to achieve beneficial occupancy In addition, the request supports the initiative to replace the aging Argus system with a modern security system, Caerus, sustains planned expansion of the Clearance Action Tracking System (CATS) and electronic personnel security file efforts, and supports highest priority continuous improvement initiatives through the PSCOE and CSTART activities. This request also includes funding for continued efforts to recapitalize security infrastructure through the highest priority SIRP projects, which address critical security systems and related security infrastructure and equipment refresh needs, as well as funding for the WEPAR project, which will install a new Perimeter Intrusion Detection and Assessment System (PIDAS) section, reducing the Y-12 National Security Complex (Y-12) Protected Area by approximately 50% while integrating with the UPF.

FY 2024–FY 2027 Key Milestones

Physical Security Systems
- Sustain counter unmanned aircraft system (CUAS) implementation and operation at sites possessing Category 0/I quantities of special nuclear material (SNM)
- Complete highest priority SIRP projects, which aligns with NNSA's priority to recapitalize security infrastructure
- Complete Caerus development and begin efforts to deploy across the NSE

Security Program Operations and Planning
- Continue DBT policy implementation

Construction
- Complete WEPAR project at Y-12

FY 2021 Accomplishments
- Continued upgrades to CATS. CATS provides remote-work-friendly adjudicative support for the eight clearance-granting offices within the Department of Energy (DOE), including the ability to provide near real-time modifications to support Trusted Workforce initiatives.
- Developed the Safeguards and Security (S&S) Career Path Guide. The Guide provides a valuable means to develop long-term career goals, expand professional capabilities, and achieve a strong S&S workforce, while providing a pipeline of capable staff for planned succession.
- Broke ground on April 7, 2021, on the WEPAR project at Y-12.
- Demonstrated initial capability of Caerus, which is a modernized and upgraded version of an integrated security system that can incorporate commercial off-the-shelf technologies while providing improved cyber security.
- Achieved initial operating capability at NNSS, and initiated installation efforts at both Pantex and Y-12, in support of the CUAS platform. NNSA is focused on addressing the threat posed by unmanned aircraft systems and the need for effective countermeasures.
- Completed Phase 3, Analysis Phase, of the DBT Implementation Strategy. With the completion of the Analysis phase, NNSA now has the information necessary to assess its security posture and make appropriate adjustments, relative to the DBT policy.
- Successfully deployed Portable Intrusion Detection System (PIDS) units for use at Y-12 in support of the WEPAR, SIRP, and UPF projects. PIDS is a rapidly deployable detection system (compensatory measure), developed in partnership with the Department of Defense to be used in a variety of potential use cases (e.g., static, strategic, tactical).

- Continued to ensure security operations could support all NNSA requirements during the COVID-19 pandemic through a multitude of contracting, policy, and logistical modifications.

Defense Nuclear Security
Operations and Maintenance

Description

DNS Operations and Maintenance integrates personnel, equipment, and procedures to protect physical assets and resources against theft, sabotage, diversion, or other criminal acts. Each NNSA contractor partner has an approved Site Security Plan detailing protection measures and resources needed to protect site security interests.

Protective Forces include duties, specialized training, performance testing, facilities, equipment, weapons/firearms, ammunition, vehicles, and other expenses. These forces are each site's primary front-line protection and consist of armed, uniformed officers. Protective Force officers are an integral part of a site's security posture and are trained in tactics and techniques necessary to protect NNSA sites.

Physical Security Systems includes highest priority SIRP projects; CUAS; intrusion detection and assessment systems; performance testing and certification/recertification; access control systems; barrier and delay mechanisms; canine explosive detection programs; and tactical systems. Many of the systems in use are well beyond their designed lifecycles and require increased maintenance and testing. Additional investments in critical security systems and infrastructure upgrade projects are necessary to sustain these systems. This includes PSCOE at Sandia National Laboratories, New Mexico, the centrally managed Argus program, and the effort to replace the aging centrally managed Argus system with Caerus, a modern security system, at sites possessing Category I quantities of SNM.

Table 1 shows the plans for the highest priority SIRP projects to be executed in FYs 2023–2027. Other than PIDAS vehicle barrier upgrades, SIRP projects do not qualify as minor construction. Rather, SIRP projects include sensor, camera, lighting, and communication refreshes, and smaller capital equipment projects. This requirement is driven by the urgent necessity to repair systems that have the highest risk of failure.

Planned FY 2023-2027 SIRP Project Allocations by Site (Dollars in Millions)		
Site	**Project Name**	**FY 2023 Allocation ($M)**
Pantex	Zone 12 North PIDAS: sensor revitalization, camera replacement, and camera tower replacement (includes power, fiber, network, sensors, and fences)	18.20
	Zone 12 Vehicle Barrier Upgrade: replaces current cable barrier	10.60
	Zone 12 East PIDAS: sensor revitalization, camera replacement, and camera tower replacement (includes power, fiber, network, sensors, and fences)	4.12
	Zone 12 Entry Control Facility Refresh: refresh sensors, cameras and gate controls	6.10
Total, FY 2023		**39.02**
Site	**Project Name**	**FY 2024 Allocation ($M)**
Pantex	Zone 12 East PIDAS: sensor revitalization, camera replacement, and camera tower replacement (includes power, fiber, network, sensors, and fences)	18.30
Total, FY 2024		**18.30**

Planned FY 2023-2027 SIRP Project Allocations by Site (Dollars in Millions)		
Site	**Project Name**	**FY 2025 Allocation ($M)**
Pantex	Zone 12 South PIDAS: sensor revitalization, camera replacement, and camera tower replacement (includes power, fiber, network, sensors, and fences)	18.30
NNSS	Device Assembly Facility: continued implementation for Protected Area revitalization work, includes PIDAS and sensor revitalization	8.90
Total, FY 2025		**27.20**
Site	**Project Name**	**FY 2026 Allocation ($M)**
NNSS	Device Assembly Facility: continued implementation for Protected Area revitalization work, includes PIDAS and sensor revitalization	30.94
	Device Assembly Facility Vehicle Barrier	7.36
Total, FY 2026		**38.30**
Site	**Project Name**	**FY 2027 Allocation ($M)**
Y-12	Y-12 Material Access Area Booths: replacement of existing booths with NNSA standard Positive Personal Identity Verification booths	6.38
NNSS	Device Assembly Facility: continued implementation for Protected Area revitalization work, includes PIDAS and sensor revitalization	20.00
Pantex	Zone 12 West PIDAS: sensor revitalization, camera replacement, and camera tower replacement (includes power, fiber, network, sensors, and fences)	19.30
Total, FY 2027		**45.68**

Information Security provides classification guidance, technical surveillance countermeasures, operations security, and classified matter protection and control.

Personnel Security includes access authorizations, badging, the Human Reliability Program, classified and unclassified visits, and foreign visits and assignments. It encompasses the administrative support for the site clearance process, including security clearance determinations at each site.

Material Control and Accountability controls and accounts for special and alternative nuclear materials through measurements, quality assurance, accounting, containment, surveillance, and physical inventory. This activity also includes the Local Area Nuclear Material Accountability System (LANMAS) software application, as well as training and operational support provided to DOE and NNSA sites and facilities.

Security Program Operations and Planning includes development of budgets, responses to audits and information requests, Site Security Plans, vulnerability/risk assessments, and performance testing and assurance activities. It also includes security incident and reporting management, security surveys and self-assessments, activities related to deviation requests, and control of security technology transfer activities. Security Program Operations and Planning also supports facility clearance processing and Foreign Ownership, Control, or Influence determinations for security contracts.

Operations and Maintenance

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Operations and Maintenance $763,078,000	**Operations and Maintenance $878,363,000**	**Operations and Maintenance +$115,285,000**
Protective Forces $410,770,000	**Protective Forces $465,546,000**	**Protective Forces +$54,776,000**
• Maintained sufficient protective forces to meet protection requirements based on approved vulnerability and risk assessments. • Addressed non-nuclear security protection requirements and "lower-level threat" scenarios, in a graded, prioritized manner. • Supported Pit Production at LANL.	• Maintains protective forces to meet protection requirements based on approved vulnerability and risk assessments. • Supports refined FY 2023 UPF security requirements. • Supports refined FY 2023 LANL Pit Production security requirements.	• Increases associated with mission growth across NNSA's NSE, including for pit production and UPF preparation efforts. • Reflects escalation, as well as balanced support for increased security requirements resulting from efforts to implement the DBT policy and increased resource needs to sustain Core Security requirements.
Physical Security Systems $127,035,000	**Physical Security Systems $169,369,000**	**Physical Security Systems +$42,334,000**
• Funds prevented and corrected maintenance for physical security systems and infrastructure at NNSA sites and provided protection against threats. • Included funding for PSCOE activities at SNL. • Sustained CUAS operation at sites possessing Category 0/I quantities of SNM. • Supported critical SIRP projects included in the 10-Year Refresh Plan at all NNSA sites.	• Funds preventive and corrective maintenance for physical security systems and infrastructure at NNSA sites and provides protection against threats. • Supports highest priority SIRP projects. • Includes funding for highest priority continuous improvement initiatives through PSCOE. • Supports Caerus. • Sustains CUAS operation at sites possessing Category 0/I quantities of SNM. • Supports refined FY 2023 UPF security requirements. • Supports refined FY 2023 LANL Pit Production security requirements.	• Reflects increased support for highest priority SIRP projects, Caerus, and support for PSCOE activities. • Increases associated with mission growth across NNSA's NSE, including for pit production and UPF preparation efforts. • Reflects escalation, as well as balanced support for increased resource needs to sustain Core Security requirements.
Information Security $51,860,000	**Information Security $61,831,000**	**Information Security +$9,971,000**
• Maintained an information protection program and sustained implementation of DOE Order 470.6, *Technical Security Program*. • Supported Pit Production at LANL.	• Maintains an information protection program and sustains implementation of DOE Order 470.6, *Technical Security Program.* • Supports refined FY 2023 LANL Pit Production security requirements.	• Increases associated with mission growth across NNSA's NSE, including for pit production and UPF preparation efforts.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
		• Reflects escalation, as well as balanced support for increased resource needs to sustain Core Security requirements.
Personnel Security $45,790,000	**Personnel Security $52,743,000**	**Personnel Security +$6,953,000**
• Maintained a personnel security program while implementing efficiencies in a risk-based manner. • Supported Pit Production at LANL.	• Maintains a personnel security program while implementing efficiencies in a risk-based manner. • Supports refined FY 2023 LANL Pit Production security requirements.	• Increases associated with mission growth across NNSA's NSE, including for Pit Production and UPF preparation efforts. • Reflects escalation, as well as balanced support for increased resource needs to sustain Core Security requirements.
Material Control and Accountability $31,690,000	**Material Control and Accountability $45,581,000**	**Material Control and Accountability +$13,891,000**
• Provided for control and accountability of special and alternative nuclear materials and maintained a level of effort that was a critical part of NNSA's layered protection program. • Sustained LANMAS software upgrade. • Supported Pit Production at LANL.	• Provides for control and accountability of special and alternative nuclear materials and maintains a level of effort that is a critical part of NNSA's layered protection program. • Sustains LANMAS software upgrade. • Supports refined FY 2023 UPF security requirements. • Supports refined FY 2023 LANL Pit Production security requirements.	• Increases associated with mission growth across NNSA's NSE, including for Pit Production and UPF preparation efforts. • Reflects escalation, as well as balanced support for increased resource needs to sustain Core Security requirements.
Security Program Operations and Planning $95,933,000	**Security Program Operations and Planning $83,293,000**	**Security Program Operations and Planning -$12,640,000**
• Maintained Site Security Plans, risk/vulnerability assessment capabilities, budget development, management of site programs for incidents of security concern, and security awareness programs. • Included funding for the CSTART effort. • Supported Pit Production at LANL.	• Maintains Site Security Plans, risk/vulnerability assessment capabilities, budget development, management of site programs for incidents of security concern, and security awareness programs. • Includes funding for highest priority continuous improvement initiatives through CSTART. • Supports refined FY 2023 UPF security requirements.	• Decrease due to use of estimated available uncosted uncommitted funding, inclusive of SPP recoveries. • Increases associated with mission growth across NNSA's NSE, including for Pit Production and UPF preparation efforts. • Reflects escalation, as well as balanced support for increased resource needs to sustain Core Security requirements.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
	• Supports refined FY 2023 LANL Pit Production security requirements.	

Defense Nuclear Security
Construction

Description

DNS construction supports critical physical security infrastructure within the NNSA NSE. This project will install a new PIDAS section to reduce the Y-12 Protected Area by approximately 50%. CD-2/3, Approve Performance Baseline & Start of Construction, was approved in January 2021. Construction began in April 2021 and will continue into the third quarter of FY 2023. CD-4 completion is scheduled for FY 2025.

Construction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Construction $26,000,000	**Construction $3,928,000**	**Construction -$22,072,000**
• Began WEPAR construction.	• Secures funding for final stages of WEPAR construction.	• Decrease reflects progress towards finalization of WEPAR project construction as well as reductions in government contingency and contractor management reserve in the associated project plan.

Defense Nuclear Security
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	4,651	2,234	2,283	-2,368
Minor Construction	N/A	N/A	73	4,410	10,600	10,527
Total, Capital Operating Expenses	**N/A**	**N/A**	**4,724**	**6,644**	**12,883**	**+8,159**
Capital Equipment > $500K (including MIE)						
Total Non-MIE Capital Equipment (>$500K and <$5M)	N/A	N/A	4,651	2,234	2,283	-2,368
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**4,651**	**2,234**	**2,283**	**-2,368**

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Minor Construction Projects (Total Estimated Cost (TEC)						
Total Minor Construction Projects (TEC <$5M)	N/A	N/A	73	0	0	-73
Y12 PIDAS Vehicle Barriers	9,160	4,750	0	4,410	0	0
Device Assembly Facility (DAF) Vehicle Barrier, NNSS	7,360	0	0	0	0	0
Zone 12 PIDAS Vehicle Barriers, PX	10,850	250	0	0	10,600	+10,600
Pantex Zone 4 PIDAS Vehicle Barriers	10,470	250	0	0	0	0
Total, Minor Construction Projects	**N/A**	**N/A**	**73**	**4,410**	**10,600**	**+10,527**
Total, Capital Summary	**N/A**	**N/A**	**4,724**	**6,644**	**12,883**	**+8,159**

Defense Nuclear Security
Construction Projects Summary

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))					
Capital Equipment >$500K (including MIE)	2,333	2,384	1,123	0	N/A
Minor Construction	0	7,360	0	0	N/A
Total, Capital Operating Expenses	**2,333**	**9,744**	**1,123**	**0**	**N/A**
Capital Equipment > $500K (including MIE)					
Total Non-MIE Capital Equipment (>$500K and <$5M)	2,333	2,384	1,123	0	N/A
Total, Capital Equipment (including MIE)	**2,333**	**2,384**	**1,123**	**0**	**N/A**

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
Minor Construction Projects (Total Estimated Cost (TEC)					
Total Minor Construction Projects (TEC <$5M)	0	0	0	0	N/A
Device Assembly Facility (DAF) Vehicle Barrier, NNSS	0	7,360	0	0	0
Pantex Zone 4 PIDAS Vehicle Barriers	0	0	0	0	10,220
Total, Minor Construction Projects	**0**	**7,360**	**0**	**0**	**N/A**
Total, Capital Summary	**2,333**	**9,744**	**1,123**	**0**	**N/A**

Defense Nuclear Security
Construction Projects Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Enacted	FY 2023 Request	FY 2023 Request vs FY 2022 Enacted ($)
17-D-710, West End Protected Area Reduction (WEPAR), Y-12						
Total Estimated Cost (TEC)	134,028	81,100	26,000	23,000	3,928	-19,072
Other Project Cost (OPC)	9,822	6,100	0	0	3,722	+3,722
Total Project Cost, 17-D-710, West End Protected Area Reduction (WEPAR), Y-12	**143,850**	**87,200**	**26,000**	**23,000**	**7,650**	**-15,350**
Total All Construction Projects						
Total Estimated Cost (TEC)	134,028	81,100	26,000	23,000	3,928	-19,072
Other Project Cost (OPC)	9,822	6,100	0	0	3,722	+3,722
Total Project Cost (TPC) All Construction Projects	**143,850**	**87,200**	**26,000**	**23,000**	**7,650**	**-15,350**

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears to Completion
17-D-710, West End Protected Area Reduction (WEPAR), Y-12					
Total Estimated Cost (TEC)	0	0	0	0	0
Other Project Cost (OPC)	0	0	0	0	0
Total Project Cost, 17-D-710, West End Protected Area Reduction (WEPAR), Y-12	**0**	**0**	**0**	**0**	**0**
Total All Construction Projects					
Total Estimated Cost (TEC)	0	0	0	0	0
Other Project Cost (OPC)	0	0	0	0	0
Total Project Cost (TPC) All Construction Projects	**0**	**0**	**0**	**0**	**0**

Defense Nuclear Security
Other Information

Full Cost Recovery Estimates

The Budget Request provides direct funding for mission-based DNS programs. Strategic Partnership Projects (formerly known as Work for Others [WFO] Projects) will continue to fund an allocable share of the base program through full cost recovery. Extraordinary security requirements for Strategic Partnership Projects, such as dedicated security for special projects or exercises on an extended basis, will be a direct charge to those customers.

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Site					
Kansas City National Security Campus	1,740	1,700	1,738	-2	-0.1%
Lawrence Livermore National Laboratory	11,168	10,597	10,820	-348	-3.1%
Los Alamos National Laboratory	5,109	6,243	6,000	+891	17.4%
NNSA Production Office	2,555	3,499	2,479	-76	-3.0%
Nevada National Security Site	1,400	800	800	-600	-42.9%
Sandia National Laboratories	25,236	24,399	24,475	-761	-3.0%
Total	**47,208**	**47,238**	**46,312**	**-896**	**-1.9%**

17-D-710 West End Protected Area Reduction
Y-12 National Security Complex, Oak Ridge, Tennessee
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History:

Summary:
The West End Protected Area Reduction (WEPAR) project is responsible for installation of a new Perimeter Intrusion Detection and Assessment System (PIDAS) section to reduce the Y-12 National Security Complex Protected Area (PA) by approximately 50%. The project consists of three main parts: PIDAS (H Road and Entry Control Facility), West End Security Transition (WEST), and Legacy PIDAS Demolition.

The FY 2023 Request for the WEPAR Project is $3,928,000 for construction, testing, and transition to operations. The current Critical Decision (CD)-2/3 was approved on January 11, 2021, by the Associate Administrator, Defense Nuclear Security, NA-70 with a Total Project Cost (TPC) of $159,850,000. A Federal Project Director (FPD) has been assigned to this project.

Significant Changes:
This project was initiated in FY 2018. This CPDS is an update of the FY 2022 CPDS and does not include a new start. The most recent DOE Order 413.3B CD was CD-2/3, Approve Performance Baseline and Start of Construction, approved on January 11, 2021, with a cost of $159,850,000 and a CD-4 approval of July 2025. The CD-2/3 WEPAR TPC is based on final design and construction bids. Project cost and schedule contingency is based on risks associated with interfaces with other Y-12 construction projects and concurrent Y-12 operations. The TPC was validated with an Independent Cost Estimate completed prior to CD-2/3. The FY 2023 request assumes reductions in government contingency and contractor management reserve below the approved baseline. Outyear funding amounts may be revised in future budget requests if additional risks are realized. There have been no significant impacts due to COVID-19.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	09/09/2017	07/25/2018	12/14/2018	1QFY2021	2QFY2020	1QFY2021	N/A	3QFY2024
FY 2022	09/09/2017	07/25/2018	12/14/2018	01/11/2021	01/11/2021	01/11/2021	N/A	07/31/2025
FY 2023	09/09/2017	07/25/2018	12/14/2018	01/11/2021	01/11/2021	01/11/2021	N/A	07/31/2025

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – N/A
CD-4 – Approve Start of Operations or Project Closeout

(dollars in thousands)

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2021	12/19/2020	N/A	N/A

CD-3A – Approve Long-Lead Procurements, Original Scope
CD-3B – Approve Long-Lead Procurements, Revised Scope

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	19,540	123,270	142,810	17,040	N/A	17,040	159,850
FY 2022	12,710	137,318	150,028	9,822	N/A	9,822	159,850
FY 2023	12,710	137,318	150,028	9,822	N/A	9,822	143,850[a]

2. Project Scope and Justification

Scope

The project will design and move the western Y-12 National Security Complex PA boundary PIDAS, design and construct a pedestrian and vehicle portal, secure facilities that fall outside of the newly established PA, and demolish legacy PIDAS structures. During the conceptual design phase, feasible options were evaluated to ensure the project scope was correctly sized to meet the site's critical mission needs. The WEPAR project will eliminate approximately 70 acres from the Y-12 PA. The new PIDAS leg will be approximately 1,750 linear feet located on the footprint that currently is H-road and then parallel to North First Street. This will provide a reduction in current PIDAS by approximately 8,000 linear feet; above-grade components of the existing/abandoned 8,000 linear feet will be demolished as part of the project. Scope also includes refurbishing legacy PIDAS south of the UPF, and converting four building areas to Limited Area (LA)s.

Justification And Mission Need

The removal of 70 acres from the PA will allow DOE/NNSA to avoid ongoing security operation requirements that are instituted within a PA, decrease costs for legacy facility operation, maintenance, and demolition, and will reduce the cost of any new facility construction to support potential mission needs in the future. This project will allow the DOE Office of Environmental Management to disposition Building 9201-5 (Alpha-5), NNSA's highest risk excess facility, outside of the PA, saving an estimated $250 million.

The WEPAR project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. Project cost and schedule contingency is based on risks associated with interfaces with other Y-12 construction projects and concurrent Y-12 operations. Funds appropriated under this data sheet are for construction and may be used for contracted support services to the Federal Program Manager and the FPD to conduct independent assessments of the planning and execution of this Project required by DOE O 413.3B and to conduct technical reviews of design and construction documents.

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

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[a] The FY 2023 request assumes reductions in government contingency and contractor management reserve below the approved baseline. Outyear funding amounts may be revised in future budget requests.

Table 5: KPP

Performance Measure	Threshold	Objective
Provide a new PIDAS boundary	Detection and assessment capability as required by DOE O 473.3A	N/A
Provide a new entry control point	Control point will provide access control and entry/exit inspection as required by DOE O 473.3A	N/A
Install annunciator agnostic communications that is compatible with current system	Satisfactory completes Assessment, Verification, Cut Over (Testing compliant with DOE O 473.3A	N/A
Secure storage in Buildings 9720-25, 9720-33, 9811-1 and 9720-59	Buildings meet DOE O 473.3A requirements	N/A

3. Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	2,500	2,500	0
FY 2018	10,210	10,210	0
FY 2019	0	0	3,462
FY 2020	0	0	7,305
FY 2021	0	0	1,943
Total Design	12,710	12,710	12,710
Construction			
FY 2017	0	0	0
FY 2018	43,390	43,390	0
FY 2019	0	0	0
FY 2020	25,000	25,000	0
FY 2021	26,000	26,000	18,566
FY 2022	23,000	23,000	55,000
FY 2023	3,928	3,928	39,000
FY 2024	0	0	8,752
Total Construction	121,318	121,318	121,318
Total Estimated Costs (TEC)			
FY 2017	2,500	2,500	0
FY 2018	53,600	53,600	0
FY 2019	0	0	3,462
FY 2020	25,000	25,000	7,305
FY 2021	26,000	26,000	20,509

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	23,000	23,000	55,000
FY 2023	3,928	3,928	39,000
FY 2024	0	0	8,752
Total TEC	134,028	134,028	134,028
Other Project Costs			
FY 2017	6,100	6,100	0
FY 2018	0	0	1,743
FY 2019	0	0	915
FY 2020	0	0	814
FY 2021	0	0	276
FY 2022	0	0	258
FY 2023	3,722	3,722	2,000
FY 2024	0	0	3,000
FY 2025	0	0	816
Total OPC	9,822	9,822	9,822
Total Project Costs (TPC)			
FY 2017	8,600	8,600	0
FY 2018	53,600	53,600	1,743
FY 2019	0	0	4,377
FY 2020	25,000	25,000	8,119
FY 2021	26,000	26,000	20,785
FY 2022	23,000	23,000	55,258
FY 2023	7,650	7,650	41,000
FY 2024	0	0	11,752
FY 2025	0	0	816
Grand Total	143,850	143,850	143,850

4. Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	12,710	12,710	12,710
Contingency	0	0	0
Total, Design	12,710	12,710	12,710
Construction			
Site Work	29,044	22,781	22,781
Equipment	7,879	7,879	7,879
Construction	77,962	71,698	71,698
D&D	2,433	2,433	2,433
Contingency	4,000	32,527	32,527
Total, Construction	121,318	137,318	137,318
Total Estimated Cost	134,028	150,028	150,028
Contingency, TEC	4,000	32,527	32,527
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	2,189	2,189	2,189
Conceptual Design	532	532	532
Other OPC Costs	5,681	5,681	5,681
Contingency	1,420	1,420	1,420
Total, OPC	9,822	9,822	9,822
Contingency, OPC	1,420	1,420	1,420
Total Project Cost	143,850	159,850	159,850
Total Contingency (TEC+OPC)	5,420	33,947	33,947

5. Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	Total
FY 2021	TEC	56,100	25,000	11,000	41,900	8,810	0	0	0	0	0	142,810
	OPC	6,100	0	3,000	3,500	3,590	850	0	0	0	0	17,040
	TPC	62,200	25,000	14,000	45,400	12,400	850	0	0	0	0	159,850
FY 2022	TEC	56,100	25,000	26,000	23,000	19,928	0	0	0	0	0	150,028
	OPC	6,100	0	0	0	3,722	0	0	0	0	0	9,822
	TPC	62,200	25,000	26,000	23,000	23,650	0	0	0	0	0	159,850
FY 2023	TEC	56,100	25,000	26,000	23,000	3,928	0	0	0	0	0	134,028
	OPC	6,100	0	0	0	3,722	0	0	0	0	0	9,822
	TPC	62,200	25,000	26,000	23,000	7,650	0	0	0	0	0	143,850

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2025
Expected Useful Life (number of years)	25
Expected Future Start of D&D of this capital asset (fiscal quarter)	4Q FY 2050

(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	2,100	2,100	63,900	63,900

7. D&D Information

The new area being constructed in this project is replacing existing facilities; however, the costs of D&D of the facilities that are being replaced are included in the costs of this construction project. The project scope includes the removal and disposition of approximately 8,000 linear feet of legacy PIDAS once WEPAR is certified. This demolition includes removal of a legacy entry portal as well.

	Square Feet (rounded to nearest 1,000)
New area being constructed by this project at Y-12	5,000
Area of D&D in this project at Y-12	1,000
Area at Y-12 to be transferred, sold, and/or D&D outside the project, including area previously "banked"	0
Area of D&D in this project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	0
Total area eliminated	0

8. Acquisition Approach

The NNSA FPD and the Integrated Project Team are responsible for the execution of the project. The Management and Operating (M&O) contractor for Y-12 is the designated design authority and overall project manager, while the Sandia National Laboratories M&O contractor's Physical Security Center of Excellence (PSCOE) is the design agent and construction manager. The NNSA Office of Defense Nuclear Security is responsible for defining program requirements, selecting the preferred alternatives, and for any project scope changes. The NNSA Office of Acquisition and Project Management is responsible for providing support for alternative studies, and serves as the lead NNSA office during design, construction, and commissioning of the project. PSCOE will play a vital role in the integration of the security features. Significant coordination with the Y-12 M&O contractor will be required for physical and technical tie-ins to current systems. As part of acquisition planning, NNSA will manage the M&O performance through the DOE/NNSA Strategic Performance Evaluation and Measurement Plan (PEMP), which sets forth the criteria by which NNSA will evaluate M&O performance and upon which NNSA shall determine the amount of award fee earned.

Information Technology and Cybersecurity

Overview

The NNSA Office of the Associate Administrator for Information Management and Chief Information Officer (OCIO) is responsible for information management, information technology (IT), and cybersecurity for NNSA. To effectively achieve this, the NNSA OCIO has implemented an organizational structure that supports its functions under three organizations: the Office of Information Technology, the Office of Cybersecurity, and the Office of Mission Integration. NNSA OCIO also collaborates and coordinates with the Department of Energy's (DOE) Office of the Chief Information Officer (DOE OCIO) on the development and deployment of IT and cybersecurity solutions to protect DOE information and information assets.

Highlights of the FY 2023 Request

The Fiscal Year (FY) 2023 budget request for the IT and Cybersecurity Program is $445.7 million. The FY 2023 budget request invests in cybersecurity capabilities, cloud-based technologies, and IT modernization and infrastructure.

The budget request enables the IT and Cybersecurity Program to operate cyber infrastructure at NNSA sites, carry out departmental policies and procedures, and execute IT services, software, and hardware solutions for NNSA computing environments. It allows the IT and Cybersecurity Program to implement Committee on National Security Systems (CNSS) requirements for the classified computing environment, the President's Executive Order on "Improving the Nation's Cybersecurity (14028)," and National Security Memorandum (NSM) 8, "Memorandum on Improving the Cybersecurity of National Security, Department of Defense, and Intelligence Community Systems."

The FY 2023 budget request prioritizes investments in IT and cybersecurity that enable the NNSA mission, such as enhancing cybersecurity tools and modernizing legacy systems. The NNSA OCIO must provide a set of capabilities that enable the mission to increase organizational efficiency, protect information assets, enhance communication with internal and external partners, ensure continuous monitoring, and support effective incident response. Finally, NNSA must transition from a defense-in-depth cybersecurity posture towards Zero Trust Architectures in accordance with Executive Order 14028.

The NNSA IT and Cybersecurity Program focuses on the development of integrated IT initiatives that provide an effective technology infrastructure to support NSE shared services. These initiatives will fundamentally redesign the NNSA IT and cybersecurity environments to provide a more secure and agile set of capabilities including unified communication, agile cloud infrastructure, and next-generation collaboration services across the NSE. The approach will provide commodity services that can be used in the future with NNSA Management and Operating (M&O) partners to improve the security of sensitive NNSA data and host shared services. Additionally, the NNSA IT and Cybersecurity Program will create a plan to explore IT application capabilities, operational technology, machine learning, and artificial intelligence to implement tools and capabilities to secure future NNSA operations.

Finally, achieving and maintaining a secure NNSA information environment for the enterprise requires an approach that combines defense-in-depth, defense-in-breadth, and zero-trust principles with essential guiding tenets that align the IT and Cybersecurity Program with NNSA cultural and business drivers. The guiding tenets that support the NNSA OCIO are risk management, agility, trust, and partnership. These tenets align the people, processes, and technology and directly contribute to the success of the IT and Cybersecurity Program.

Information Technology and Cybersecurity
Funding

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Information Technology and Cybersecurity					
Cybersecurity					
Site Infrastructure	106,151	106,151	87,357	-18,794	-17.7%
Enterprise Operations	145,321	145,321	128,094	-17,227	-11.9%
Subtotal, Cybersecurity	**251,472**	**251,472**	**215,451**	**-36,021**	**-14.3%**
Information Technology	114,761	114,761	230,203	+115,442	+100.6%
Total, Information Technology and Cybersecurity	**366,233**	**366,233**	**445,654**	**+79,421**	**+21.7%**

Information Technology and Cybersecurity
Outyear Funding

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request
Information Technology and Cybersecurity				
Cybersecurity				
Site Infrastructure	91,026	110,294	116,080	133,136
Enterprise Operations	146,867	158,705	155,650	167,977
Subtotal, Cybersecurity	**237,893**	**268,999**	**271,730**	**301,113**
Information Technology	256,231	244,890	262,715	286,087
Total, Information Technology and Cybersecurity	**494,124**	**513,889**	**534,445**	**587,200**

Information Technology and Cybersecurity
Explanation of Major Changes

	FY 2023 Request vs FY 2021 Enacted ($)
Information Technology and Cybersecurity	
Cybersecurity: The funding decrease reflects a reclassification of certain initiatives from the Cybersecurity Enterprise Operations subprogram to the IT Program. Some of the reclassified initiatives include the modernization of the network architecture, as well as upgrades and enhanced security capabilities for the classified systems, including the Emergency Communications Network (ECN). The Cybersecurity Enterprise Operations subprogram now reflects the investments in cybersecurity tools and services provided to the enterprise.	**-36,021**
Information Technology: The funding increase reflects a reclassification of certain initiatives from the Cybersecurity Enterprise Operations subprogram to the IT Program. Some of the reclassified initiatives include the modernization of the network architecture, as well as upgrades and enhanced security capabilities for the classified systems, including ECN. The increase includes the cost associated with continued modernization of classified infrastructure and capabilities and additional costs for DOE Energy Information Technology Services (EITS) unclassified desktop commodity IT services. Such costs will improve unclassified and classified collaboration tools, network services, and reflect NNSA OCIO priorities. Finally, the additional funding will improve the reliability of video teleconference (VTC) capabilities for classified systems and implementation of a cloud infrastructure. This infrastructure will provide redundancy and improve performance for mission partners globally.	**+115,442**
Total, Information Technology and Cybersecurity	**+79,421**

Information Technology and Cybersecurity
Cybersecurity

Cybersecurity is not only about mitigating risk, but it is also about keeping up with ever-changing threats and vulnerabilities. NNSA will reduce threats by minimizing attack surfaces and find innovative ways to support the mission goals and objectives of the NSE. To ensure mission success, the NNSA IT and Cybersecurity Program is committed to maintaining and modernizing the IT and cybersecurity infrastructure that supports mission activities within the weapons program classified information processing environment, nuclear material transport, weapon modernization, and incident response.

The NNSA relies on the OCIO's ability to successfully detect, deny, disrupt, and degrade malicious events and activities on our networks and systems.

Description

The Cybersecurity program is organized into two subprograms: Site Infrastructure and Enterprise Operations.

The Site Infrastructure subprogram supports the cybersecurity operations and activities at NNSA M&O and Federal sites. The subprogram is built around a defense-in-depth approach for achieving cybersecurity in a highly networked environment. NNSA OCIO will transition from a defense-in-depth cybersecurity posture towards Zero Trust Architectures in accordance with Executive Order 14028. Funds provided under the Site Infrastructure subprogram sustain sites and M&Os local cybersecurity operations in support of NNSA mission priorities in accordance with DOE and NNSA policy. Efforts currently underway include implementing the NNSA Application Modernization Strategy that is critical for mission applications required for weapons design. The strategy ensures applications introduced into this environment undergo rigorous supply chain risk management processes including source code scanning.

The Enterprise Operations subprogram provides essential cybersecurity support and operations to the NNSA enterprise through the Information Assurance Response Center (IARC) monitoring services, including audits, assessments, policy, management, planning, and training. The IARC is a security operations center (SOC) that provides 24/7/365 cybersecurity services to NNSA and DOE networking enclaves. The IARC also provides near real-time network defense and incident response services that protect these classified and unclassified enclaves and information from attacks. As a participant with DOE's Integrated Joint Cybersecurity Coordination Center (iJC3) Program, the IARC also supports enterprise-level cyber threat management and situational awareness for DOE. The Enterprise Operations subprogram is responsible for developing and advancing policies and initiatives that support short and long-term solutions to specific cybersecurity needs at NNSA sites and headquarters locations. Finally, the Enterprise Operations subprogram focuses on emerging technologies and leveraging existing technology resources to create a more secure environment.

The protection of the core information assets, networks, applications, and systems includes an enterprise-level identity model, strong (two-factor) authentication, and a centralized monitoring and analysis capability. These components provide a secure infrastructure system required to sustain the stockpile stewardship program. The protected networks provide a broad base of security and network services that include application integration, authentication services, directory services, enterprise data resource management, the IARC SOC and network operations center (NOC), identity and access management (IAM), public key infrastructure (PKI), and security monitoring and intrusion detection. An example of this is the ongoing project to complete the implementation of PKI smart cards. This effort will result in the issuance of tokens, enabling network login to DOE Secret Fabric users to meet CNSS requirements.

Highlights of the FY 2023 Budget Request

- Implement a strong and comprehensive Cybersecurity Program to support and enhance the NSE mission goals and objectives improving safety, security, and efficiency.
- Implement the President's Executive Order on "Improving the Nation's Cybersecurity (14028)" and NSM-8. This includes continuing to transition from a defense-in-depth cybersecurity posture towards Zero Trust Architectures.
- Implement orchestration and automation of cybersecurity capabilities to detect, prevent, counter, and respond to emerging cybersecurity threats and vulnerabilities reducing human error and enabling repurposing of staff.

- Continue to increase understanding, capabilities, and maturity around operational technology and its risk to the nuclear security enterprise.
- Continue to evolve unified communications capabilities to enhance information sharing between other government agencies (OGA) and NNSA.
- Continue the modernization of the Enterprise Secure Computing (ESC) environments by enhancing core services and collaborative capabilities and consolidating disparate network infrastructure.
- Create and actualize a plan to utilize emerging technology, machine learning, and artificial intelligence to secure future NNSA operations.
- Engage externally with OGAs, enhance partnerships, share lessons learned, and modernize the way NNSA executes its mission.

FY 2024 – FY 2027 Key Milestones

- Establish additional Centers of Excellence to improve and enhance cyber security operations throughout the nuclear security enterprise in FY 2025.
- Secure the enterprise information infrastructure, critical assets, and capabilities through robust and proactive cybersecurity.
- Reinforce security posture for highly classified information and enhance the capability to share information with the Department of Defense (DoD). This includes modernizing the network architecture, as well as upgrades and enhancing security capabilities for the classified systems, including ECN.
- Continue developing and implementing a cybersecurity framework for IT to include network connected operational technologies and systems.

FY 2021 Accomplishments

- Collaborated with an OGA mission partner to successfully establish a secure community of interest related to restricted data sharing.
- Completed initial operating capability of NNSA's network modeling and risk scoring platform, enabling a more resilient enterprise.
- Completed the replacement of the IARC Enterprise SIEM tool enhancing continuous monitoring, threat detection, and rapid investigation and response.
- Completed the recapitalization of NNSA's deployed sensor platform enhancing deployed monitoring capabilities.

Cybersecurity
Funding

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Cybersecurity: $251,472,000	**Cybersecurity: $215,451,000**	**Cybersecurity: -$36,021,000**
Site Infrastructure: $106,151,000	**Site Infrastructure: $87,357,000**	**Site Infrastructure: -$18,794,000**
• Funded cybersecurity operations of the NNSA sites. • Continued modernization of the Cybersecurity programs at the national security laboratories, plants, and sites to defend against increasingly adaptive threats. • Strengthened the M&O cybersecurity operations at each NNSA site along the defense-in-depth approach.	• Continues cybersecurity operations of the NNSA sites and maintains FY 2022 resource level. • Maintains core cybersecurity operations at M&Os, NNSA laboratories, plants, and sites to ensure the protection of NSE information and information assets. • Enables the achievement of federal standards such as NIST and CNSS requirements; implementing the President's Executive Order on "Improving the Nation's Cybersecurity (14028);" and, finally, DOE and NNSA policy, procedures, and guidance.	• The decrease in funding reflects a reclassification of initiatives from the Site Infrastructure subprogram to the Enterprise Operations subprogram, including enterprise level efforts such as the Risk Management Framework, support for maintaining operational capabilities for cybersecurity and network defense, and additional one time M&O cybersecurity requirements.
Enterprise Operations: $145,321,000	**Enterprise Operations: $128,094,000**	**Enterprise Operations: -$17,227,000**
• Provided funding for Enterprise Operations and procurement of cybersecurity tools for the protection of the NNSA Cybersecurity Infrastructure. • Reinforced the enterprise network security posture by continuing to address known critical capability gaps at the IARC. • Initiated modern cross-domain solution to replace the last legacy gateways currently in production. • Expanded the application of Digital Rights Management (DRM)/Data Loss Protection (DLP) Technology.	• Supports cyber services including the labor, software, and hardware necessary to manage the Cybersecurity Program. The labor includes areas such as accreditation and the 2x7x365 security monitoring, as well as forensics and incident management and response. • Transitions to a managed service support contract model with discrete work scope for each task. The new approach enables NNSA to take advantage of new and emerging technologies while maximizing efficient use of resources. IT services have been delivered to NNSA through a build, own, and operate model supported by a firm fixed price small business contract. This model is unable to keep pace with the rapid innovation of IT and cybersecurity.	• The decrease in funding reflects a reclassification of initiatives from the Enterprise Operations subprogram to the Information Technology Program, including the ECN, unclassified desktop commodity IT services provider costs, Data Center Solution, ESC modernization, other classified networks, and other services.

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
	• Supports enterprise efforts that leverage the research/ Strategic Partnership Program (SPP) work on a site to bring a cyber function to the enterprise. The efforts are led by a primary site with interaction at each NNSA location. • Develops an architecture and commercial classified solution for classified wireless throughout the NSE. • Provides funding for tools procurement and licensing for locations without the appropriate security tools to meet Continuous Diagnostics and Mitigation (CDM) requirements. • Supports the cybersecurity requirements outlined within the Executive Order 14028, that requires compliance-based evaluation of cybersecurity.	

Information Technology and Cybersecurity
Information Technology

Description
NNSA OCIO directs the design, development, and maintenance of all aspects of NNSA computing and provides NNSA staff with the IT resources necessary to achieve mission goals and objectives. The IT Program supports the infrastructure and protection for both classified and unclassified computing networks, secure communications, applications, systems, and logical environments. It ensures electronic information and information assets are operating efficiently and effectively and are protected from unauthorized access and malicious acts that would adversely affect national and economic security. The IT Program provides enterprise-level classified computing infrastructure, and unclassified applications services to NNSA Federal staff in support of the NNSA mission. The IT Program also leverages cloud-based services and solutions whenever possible to support infrastructure hosting and application development, operations, and maintenance.

IT classified computing enables DOE/NNSA laboratories and sites to communicate and share information regarding NNSA's mission. The program supports IT systems and networks and serve as the computer network defense service provider for the Secret Fabric for the Department.

- The NNSA Secret Network (NSN) supports the processing of Secret/National Security Information (NSI) and the interconnection with the DoD SIPRNET.
- ECN supports DOE/NNSA mission elements to provide continuous, effective, and secure network services (data-video-voice) for all DOE/NNSA response components and shall be reliably maintained at rest and throughout operational emergencies.
- The ESC environment operates at the Secret/Restricted Data level and consists of independent site installations of standardized hardware and software integrated through a common infrastructure and shared policies and procedures.
- Support other classified networks that enable the communication and sharing of information regarding NNSA's mission.

To think, behave, and respond as one cohesive agency with a shared, critical national security mission, it is necessary to re-engineer the telecommunications networks and improve service offerings to remove technical barriers and complexities to collaboration and outfit employees with effective communication tools to maximize efficiency and lower operational costs. To that end, the IT Program enhances enterprise services to support emerging technologies and the NNSA mission. Classified computing is currently deployed at NNSA and multiple DOE sites, Federal departments, other organizations, and select allied nations. The footprint of the enterprise networks continues to expand as NNSA's mission requirements increase and/or change.

The Enterprise Secure Network (ESN) serves as the base network for the classified commodity services, which entails an approach to classified collaborative computing that uses a secure Virtual Desktop Infrastructure (VDI) to facilitate information sharing among disparate DOE/NNSA entities. The IT Program consistently evaluates the site installations for areas that can be consolidated to enterprise services and could be centrally hosted and managed.

IT commodity-based computing infrastructure facilitates effective collaboration and information sharing for NNSA Federal employees and support contractors to execute the NNSA mission. Through regular communication with DOE/NNSA leadership, DOE IT organizations, contract partners in the labs and field, and associates across the Federal IT community, NNSA has identified an opportunity to push modernization efforts to implement an IT strategy that leverages managed services and cloud technologies. NNSA's focus on a managed service model enables NNSA to take advantage of new and emerging technologies while maximizing efficient use of resources. The strategy presents many opportunities to participate in economies of scale and rely on industry's rapid development and testing practices to ensure NNSA is using secure, modern technology.

Highlights of the FY 2023 Budget Request

- Implement a strong and comprehensive IT Program that supports the NSE mission through the recapitalizing and modernizing of aging logical infrastructure.
- Shift to a managed service model that will enable and support new technologies.

- Create and actualize a plan to utilize IT research and development capabilities, operational technology, machine learning, and artificial intelligence to secure future NNSA operations.
- Strengthen inherited legacy networks, systems, and applications and continue modernization of ECN.
- Implement the NNSA Application Modernization Strategy for both mission and non-mission applications.
- Support the modernization of networks and leverage cloud technologies to strengthen and eliminate redundancies.
- Engage externally with other government agencies and mission partners.
- Improve the reliability of VTC capabilities for classified systems.

FY 2024 – FY 2027 Key Milestones
- Provide classified IT infrastructure enhancements and improvements to support both the nuclear security and non-nuclear security activities across the DOE enterprise.
- Develop architecture of the classified wireless network for non-pit production facilities.
- Leverage modern systems and secure data transfer technologies to improve collaboration and coordination.
- Increase automation capabilities to perform rapid, reliable, consistent, and secure technology deployments.
- Partner with DOE OCIO, DOE IN, M&Os, and OGAs to ensure technology services meet organizational requirements and to provide the systems, tools, training, and support to leverage NNSA data for mission needs.
- Develop a roadmap to support and sustain advanced analytic capabilities, including artificial intelligence and machine learning, from the research and development phase to production and deployment.

FY 2021 Accomplishments
- Implemented Phase I of the IT Modernization Project by working closely with the Department and element CIOs and IT Managers to move to Windows 10 and Microsoft 365.
- Developed and implemented services and solutions to provide operational connectivity during COVID 19.
- Improved application development and implementation with updated tools and technologies.

Information Technology
Funding

Activities and Explanation of Changes

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted ($)
Information Technology: $114,761,000	**Information Technology: $230,203,000**	**Information Technology: +$115,442,000**
• Continued to support the deployment of information technology enhancements that facilitate effective collaboration and information sharing necessary for NNSA Federal employees and support contractors to carry out the NNSA's mission. • Continued to provide Information Technology technical services, incidental advisory, and assistance services. • Continued to oversee the implementation of hardware and software licensing, maintenance, and refresh. • Continued providing funding support for NNSA field office Information Technology services provisioned by M&O partners. • Continued oversight of the M&O partners' unclassified Information Technology programs. • Continued implementation of the application modernization project. • Continued implementation of Enterprise Voice over Internet Protocol (VoIP) as a service. • Provided oversight of activities related to, and ensure agency compliance with, the provisions of FITARA. • Enabled Information Technology operations and maintenance of the Secret and Restricted Data infrastructure, Enterprise Secure Network, NNSA Secret Network, and utilization of the ESNet infrastructure for the network transport layer.	• Supports ESC including the labor, hardware, and software to support the ESN and NSN. environments managed by the NNSA OCIO with support from the M&O partners. • Transitions the NNSA OCIO into a managed service model in FY 2023. The OCIOs focus on a managed service model enables NNSA to take advantage of new and emerging technologies while maximizing efficient use of resources. • Promotes modernization of the network architecture, as well as upgrades and enhances security capabilities for the classified systems, including ECN. • Supports IT services for NNSA Federal staff. This includes the cost of unclassified applications, software, hardware, and local classified labor and software/hardware and unclassified. • Provide support for unclassified desktop commodity IT services. • Supports operation of classified networks not included in ESC with unique mission requirements that require separate systems. • Improves the reliability of VTC capabilities for classified system.	• Reflects a reclassification of initiatives from the Enterprise Operations subprogram to IT Program, including the ECN, unclassified desktop commodity IT services provider costs, Data Center Solution, ESC modernization, other classified networks, and other services. • Deploys a third data center in support of the modernization and development of the ESC environment, including enhancing the core services and collaborative capabilities and consolidating disparate network infrastructure. . This will increase redundancy and strengthen continuity of operations (COOP).

Information Technology and Cybersecurity
Other Information

Full Cost Recovery Estimates

The FY 2023 Budget Request provides direct funding for mission-driven activities to achieve IT and cybersecurity solutions. Because some support is directed to other programs for materials and services provided to agencies outside the Department, these costs will be allocated to the SPP customers as work is accomplished at the contractor site. The table below provides an estimate of costs that will be recovered from SPP customers.

(Dollars in Thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)	FY 2023 Request vs FY 2021 Enacted (%)
Site					
Kansas City National Security Campus	657	657	710	+53	8.1%
Lawrence Livermore National Laboratory	2,470	2,470	2,400	-70	-2.8%
Los Alamos National Laboratory	1,252	1,252	1,216	-36	-2.8%
Nevada National Security Site	400	400	400	0	0%
NNSA Production Office	86	86	98	+12	13.9%
Sandia National Laboratories	8,137	8,137	9,734	+1,598	19.6%
Savannah River Site	0	0	0	0	0%
Total	**13,001**	**13,001**	**14,558**	**+1,557**	**12.0%**

Information Technology and Cybersecurity
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted ($)
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	1,018	0	0	-1,018
Minor Construction	0	0	0	0	0	0
Total, Capital Operating Expenses	**N/A**	**N/A**	**1,018**	**0**	**0**	**-1,018**
Capital Equipment > $500K (including MIE)						
Total Non-MIE Capital Equipment (>$500K and <$5M)	N/A	N/A	1,018	0	0	-1,018
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**1,018**	**0**	**0**	**-1,018**
Minor Construction Projects (Total Estimated Cost (TEC)						
Total Minor Construction Projects (TEC <$5M)	N/A	N/A	0	0	0	0
Total, Minor Construction Projects	**N/A**	**N/A**	**0**	**0**	**0**	0
Total, Capital Summary	**N/A**	**N/A**	**1,018**	**0**	**0**	**-1,018**

Outyears for Information and Technology and Cybersecurity

(Dollars in Thousands)

	FY 2024 Request	FY 2025 Request	FY 2026 Request	FY 2027 Request	Outyears
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))					
Capital Equipment >$500K (including MIE)	0	0	0	0	N/A
Minor Construction	0	0	0	0	N/A
Total, Capital Operating Expenses	**0**	**0**	**0**	**0**	**N/A**
Capital Equipment > $500K (including MIE)					
Total Non-MIE Capital Equipment (>$500K and <$5M)	0	0	0	0	N/A
Total, Capital Equipment (including MIE)	**0**	**0**	**0**	**0**	**N/A**
Minor Construction Projects (Total Estimated Cost (TEC)					
Total Minor Construction Projects (TEC <$5M)	0	0	0	0	N/A
Total, Minor Construction Projects	**0**	**0**	**0**	**0**	**N/A**
Total, Capital Summary	**0**	**0**	**0**	**0**	**N/A**