

Science Laboratories Infrastructure

Overview

The Science Laboratories Infrastructure (SLI) program mission is to support scientific and technological innovation at the Office of Science (SC) laboratories by funding and sustaining general purpose infrastructure and fostering safe, efficient, reliable, and environmentally responsible operations. The main priorities of the SLI program are improving SC's existing physical assets (including major utility systems) and funding new cutting-edge facilities that enable emerging science opportunities. The SLI program also funds Payments in Lieu of Taxes (PILT) to local communities around the Argonne, Brookhaven, and Oak Ridge National Laboratories as well as Nuclear Operations at Oak Ridge National Laboratory (ORNL) and landlord responsibilities across the Oak Ridge Reservation.

SC manages an infrastructure portfolio worth nearly \$22.0 billion, which is composed of 13 sites with nearly 23 million gross square feet (gsf) in 1,570 government owned buildings. SC assets at their 10 national laboratories include major research and user facilities, laboratory and office buildings, support facilities, and a vast network of utilities that form the backbone of each site. While SC has provided significant stewardship of research facilities, the renovation and replacement of general purpose infrastructure, including buildings and support infrastructure, continues to lag behind. Of the buildings, 47 percent are rated substandard or inadequate to meet mission needs. In addition, 64 percent of support infrastructure, including utility systems, is rated as substandard or inadequate, resulting in unplanned outages, costly repairs, and inefficiencies. Collectively, these deficiencies impede mission accomplishment and scientific progress. In collaboration with SC programs and the laboratories, the SLI program works to address identified deficiencies.

SC laboratories conduct rigorous and consistent analyses of the condition, utilization, and functionality of the facilities and infrastructure which are most critical to mission accomplishment. SC and the laboratories use these assessments to develop comprehensive Campus Strategies in the annual laboratory planning process. Each laboratory's Campus Strategy identifies activities and infrastructure investments (e.g., Line-Item (LI) Construction and General Plant Projects (GPPs)) required to support the core capabilities and achieve the scientific vision of the laboratory. SC leadership uses these Campus Strategies to determine the facilities and infrastructure needs and priorities, which, combined with complex-wide infrastructure analyses, form the basis of SLI Budget requests.

To sustain and enhance its general purpose infrastructure, SC invested nearly \$500,000,000 in maintenance, repair, and upgrades in FY 2019. These investments came from a variety of funding sources including Federal appropriations for line-item and general plant projects and overhead funding of Institutional GPP (IGPP) projects and maintenance and repair. The SLI investments in line-item construction and science-supporting infrastructure are key elements of this overall investment strategy.

Highlights of the FY 2021 Request

The SLI program Request for \$174,110,000 continues to focus on improving infrastructure across the SC national laboratory complex. The FY 2021 Request includes funding for three new construction starts: the Princeton Plasma Innovation Center at Princeton Plasma Physics Laboratory (PPPL), the Critical Infrastructure Recovery & Renewal project at PPPL, and the Ames Infrastructure Modernization project at Ames Laboratory.

The Request also supports fifteen ongoing construction projects: the Critical Utilities Rehabilitation Project at Brookhaven National Laboratory (BNL), the Seismic and Safety Modernization project at Lawrence Berkeley National Laboratory (LBNL), the Continuous Electron Beam Accelerator Facility (CEBAF) Renovation and Expansion project at Thomas Jefferson National Accelerator Facility (TJNAF), the Large Scale Collaboration Center at SLAC National Accelerator Laboratory (SLAC), the Argonne Utilities Upgrade project at Argonne National Laboratory (ANL), the Linear Assets Modernization Project at LBNL, the Critical Utilities Infrastructure Revitalization project at SLAC, the Utilities Infrastructure Project at Fermi National Accelerator Laboratory (FNAL), the Science User Support Center at BNL, the Translational Research Capability project at Oak Ridge National Laboratory (ORNL), the Biological and Environmental Program Integration Center (BioEPIC) at LBNL, and the Integrated Engineering Research Center at FNAL, and provides final funding for three construction projects: the Craft Resources Support Facility at ORNL, the Tritium System Demolition and Disposal project at PPPL, and the Energy Sciences Capability project at Pacific Northwest National Laboratory (PNNL). These ongoing projects, along with the newly proposed

projects, will upgrade and improve aging utility systems and facilities and provide new laboratory space with the necessary performance capabilities to enhance SC's mission.

The FY 2021 Request also includes funding for general purpose infrastructure projects that will address high priority core infrastructure and utility needs across SC laboratories and facilities. The laboratory infrastructure needs and priorities are reevaluated annually by SLI.

**Science Laboratories Infrastructure
Funding**

(dollars in thousands)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
Infrastructure Support	79,690	93,000	22,710	-70,290
Construction				
21-SC-71, Princeton Plasma Innovation Center, PPPL	—	—	2,000	+2,000
21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL	—	—	2,000	+2,000
21-SC-73, Ames Infrastructure Modernization, Ames	—	—	2,000	+2,000
20-SC-71, Critical Utilities Rehabilitation Project, BNL	—	20,000	15,000	-5,000
20-SC-72, Seismic and Safety Modernization, LBNL	—	10,000	10,000	—
20-SC-73, CEBAF Renovation and Expansion, TJNAF	—	2,000	2,000	—
20-SC-74, Craft Resources Support Facility, ORNL	—	15,000	25,000	+10,000
20-SC-75, Large Scale Collaboration Center, SLAC	—	11,000	8,000	-3,000
20-SC-76, Tritium System Demolition and Disposal, PPPL	—	13,000	19,400	+6,400
20-SC-77, Argonne Utilities Upgrade, ANL	—	500	2,000	+1,500
20-SC-78, Linear Assets Modernization Project, LBNL	—	500	2,000	+1,500
20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC	—	500	2,000	+1,500
20-SC-80, Utilities Infrastructure Project, FNAL	—	500	2,000	+1,500
19-SC-71, Science User Support Center, BNL	7,000	20,000	7,000	-13,000
19-SC-72, Electrical Capacity and Distribution Capability, ANL	30,000	30,000	—	-30,000
19-SC-73, Translational Research Capability, ORNL	25,000	25,000	10,000	-15,000
19-SC-74, BioEPIC, LBNL	5,000	15,000	6,000	-9,000
18-SC-71, Energy Sciences Capability, PNNL	24,000	23,000	23,000	—
17-SC-71, Integrated Engineering Research Center, FNAL	20,000	22,000	12,000	-10,000
17-SC-73, Core Facility Revitalization, BNL	42,200	—	—	—
Total, Construction	153,200	208,000	151,400	-56,600
Total, Science Laboratories Infrastructure	232,890	301,000	174,110	-126,890

**Science Laboratories Infrastructure
Explanation of Major Changes**

(dollars in thousands)

FY 2021 Request vs FY 2020 Enacted

Infrastructure Support

The Request continues funding to support Payment in Lieu of Taxes (PILT), nuclear facilities at ORNL, and landlord responsibilities at the Oak Ridge Reservation. Overall funding decreases due to the request for final funding in FY 2020 for the de-inventory, removal, and transfer of nuclear material at Building 350, formerly the site of New Brunswick National Laboratory (NBL) on the ANL campus. Funding for critical core infrastructure across the SC complex also decreases in FY 2021.

-70,290

Construction

Funding supports fifteen ongoing line-item projects at FNAL, PNNL, LBNL, ANL, ORNL, BNL, SLAC, PPPL, and TJNAF. The increase also supports the initiation of three new line-item projects at Ames and PPPL.

-56,600

Total, Science Laboratories Infrastructure

-126,890

Program Accomplishments

Since FY 2006, the SLI program has invested over \$1.5 billion in general purpose infrastructure across the SC-stewarded laboratory complex. These investments have provided state-of-the-art science user support facilities, renovated and repurposed aged facilities, upgraded inadequate core infrastructure and systems, and removed excess.

Line-Item Construction Projects.

Since FY 2006, the SLI program has successfully completed 15 line-item projects while garnering eleven DOE Secretary's Achievement Awards. These investments occurred following an FY 2006 SC decision to initiate a major effort to modernize infrastructure across the SC-stewarded laboratory complex. With these investments, the SLI program constructed more than 1,120,000 gsf of new space and modernized more than 450,000 gsf of existing space. As a result, an estimated 2,500 laboratory users and researchers now occupy newly constructed and/or modernized buildings that better support scientific and technological innovation in a collaborative environment.

Core General Plant Project upgrades across SC Laboratories.

Since FY 2016, SLI has funded over \$150,000,000 in laboratory core infrastructure improvements including over \$97,000,000 in electrical and utility improvements and over \$44,000,000 in facility improvements. Examples of recent SLI investments in core infrastructure include renovating post-World War II era laboratory and support space and contamination mitigation at BNL, upgrading an outdated legacy fabrication facility at ORNL, and renovating mission critical buildings at Ames Laboratory. At LBNL, SLI funded the replacement of inadequate critical portions of the supply water and storm water drainage systems that serve all SC programs. At ANL, SLI funded upgrades to the laboratory's water and sewer system. At the Oak Ridge Institute for Science and Education (ORISE), SLI funded electrical and infrastructure improvements. Lastly, at SLAC, SLI funded the replacement of the low conductivity water cooling system and cooling towers serving the Stanford Synchrotron Radiation Light Source and the Linac Coherent Light Source.

Building 350 Legacy Project at Argonne National Laboratory (ANL).

As of the end of FY 2019, this SLI-funded project removed 16,944 of the approximately 20,000 nuclear material items from the former New Brunswick Laboratory building. The project also cleaned up approximately 20,481 square feet of the building's 28,598 total square feet that is within this project's scope for cleanout, a part of which is currently being used for programmatic work. The project continues to remove the remaining nuclear materials and clean-up space so the building can eventually be renovated and repurposed as a radiological facility by ANL, with project completion scheduled for FY 2022.

Infrastructure and Operational Improvements project at PPPL.

This project addressed inadequate facilities at PPPL that were impeding progress towards achieving research goals as well as hindering the attraction and retention of talented staff. It included renovation of 70,000 gsf of space in existing buildings to provide space for offices and equipment, and demolition of trailers used for office space and storage of equipment. This project was completed in FY 2019 and has provided the laboratory with upgraded infrastructure to support its mission of advancing the fields of fusion energy and plasma physics research necessary to realize fusion as an energy source.

Photon Science Laboratory Building at SLAC.

This project provided modern day laboratory space to accommodate a range of simulation, theory, and modeling for synthetic and characterization capabilities, while also supporting research collaborations with outside scientists engaged with SLAC's LCLS and SSRL user facilities. This was accomplished through a partnership with Stanford University, SLAC, and DOE. Stanford University provided a three-story building shell and the DOE provided 65,000 gsf of wet labs, dry labs, vibration-sensitive labs, cleanrooms, offices, and meetings rooms in support of the project's Mission Need Statement. The project was completed in FY 2019.

Material Design Laboratory at ANL.

This project provided a 124,000 gsf high performance laboratory building, with a variety of laboratories (including radiological labs), offices, meeting rooms, interaction areas and support functions for energy-related research and development. The building was programmed to meet the minimum needs of the Materials for Energy programs consistent with SC's vision for these programs at ANL: Frontiers of materials, molecular synthesis, and fabrication of devices; Interfacial engineering for energy applications; Materials under extreme conditions; and In situ characterization and modeling.

Science Laboratories Infrastructure Infrastructure Support

Description

This subprogram funds infrastructure support investments that focus on laboratory core infrastructure and operations. Continuing Investments in core infrastructure (e.g., utility systems, site-wide services, and general purpose facilities) ensure that facilities and utilities are upgraded or replaced when they approach end-of-life, have improved reliability, efficiency, and performance, and that excess space is removed so that it no longer requires operation and maintenance funding and frees up valuable space for re-utilization. Without this type of investment, SC laboratories would not be able to keep up with needed upgrades and repairs. The funded activities include core infrastructure upgrades at various laboratories, general infrastructure support, and support for the nuclear facilities at ORNL.

This subprogram also funds Payment In Lieu of Taxes (PILT) to local communities around ANL, BNL, and ORNL, as well as stewardship-type needs (e.g., roads and grounds maintenance) across the Oak Ridge Reservation.

Facilities and Infrastructure

This activity funds infrastructure support investments that focus on laboratory core infrastructure and operations. SC laboratories conduct rigorous condition assessments of their core infrastructure, which determine the need for investments in these basic systems that form the backbone of their campuses. Each year, the SLI program continues this focus and collaborates with the SC research programs to review proposed investments and maintains an active list of critical core infrastructure needs. Priorities are evaluated continuously and the highest priority projects are selected for funding upon entry into the corresponding execution year.

Nuclear Operations

To support critical DOE nuclear operations, this Request includes base funding to operate ORNL's nuclear facilities (i.e., Buildings 7920, 7930, 3525, and 3025E). These facilities support a variety of users including the National Nuclear Security Agency (NNSA), SC, the Office of Nuclear Energy (NE), and other agencies. This funding supports maintenance and repair of hot cells and supporting systems while ensuring compliance with safety standards and procedures.

Oak Ridge Landlord

This funding supports landlord responsibilities, including infrastructure for the 24,000 acre Oak Ridge Reservation and DOE facilities in the city of Oak Ridge, Tennessee. Activities include maintenance of roads, grounds, and other infrastructure; and support and improvement of environmental protection, safety, and health.

Payments in Lieu of Taxes

Funding within this activity supports SC stewardship responsibilities for PILT. The Department is authorized to provide discretionary payments to state and local government authorities for real property that is not subject to taxation because it is owned by the United States Federal Government and operated by the Department. Under this authorization, PILT is provided to communities around ANL, BNL, and ORNL to compensate for lost tax revenues for land removed from local tax rolls. PILT payments are negotiated between the Department and local governments based on land values and tax rates.

**Science Laboratories Infrastructure
Infrastructure Support**

Activities and Explanation of Changes

(dollars in thousands)

FY 2020 Enacted	FY 2021 Request	Explanation of Changes FY 2021 Request vs FY 2020 Enacted
Infrastructure Support	\$93,000	\$22,710
Facilities and Infrastructure	\$56,850	-\$50,650
Funding continues to support de-inventory and removal of nuclear material at the former New Brunswick Laboratory (NBL) Building at ANL, and the highest priority core infrastructure needs. In addition, this funding supports the acquisition of real property at PNNL.	The Request will continue to support the highest priority core infrastructure needs across the SC complex.	Funding decreases to reflect the request for final funding in FY 2020 for both the NBL de-inventory project and the completion of acquisition of real property at PNNL. Funding is also reduced for critical core infrastructure needs.
Nuclear Operations	\$26,000	-\$20,000
Funding continues to support critical nuclear operations and provides funding to manage ORNL's nuclear facilities.	The Request will continue to support critical nuclear operations and will provide funding to manage ORNL's nuclear facilities.	Funding supports the most critical nuclear operations and facilities at ORNL.
Oak Ridge Landlord	\$5,610	+\$250
Funding supports landlord responsibilities across the Oak Ridge Reservation. Activities include maintenance of roads, grounds, and other infrastructure; and support and improvement of environmental protection, safety, and health.	The Request will continue support of landlord responsibilities across the Oak Ridge Reservation. Activities include maintenance of roads, grounds, and other infrastructure; and support and improvement of environmental protection, safety, and health.	Funding increases to address necessary road maintenance and repairs.
Payment in Lieu of Taxes	\$4,540	+\$110
Funding supports PILT payments to communities around ANL, BNL, and ORNL.	The Request will provide funding for PILT payments to communities around ANL, BNL, and ORNL.	Funding increases to support anticipated PILT requirements in FY 2021.

Science Laboratories Infrastructure Construction

Description

The SLI Construction program funds line-item projects to maintain and enhance the general purpose infrastructure at SC laboratories. SLI's infrastructure modernization construction projects are focused on the accomplishment of long-term science goals and strategies at each SC laboratory.

The FY 2021 Request includes funding for:

Three new line-item construction projects:

- Princeton Plasma Innovation Center at PPPL;
- Critical Infrastructure Recovery & Renewal at PPPL; and
- Ames Infrastructure Modernization at Ames.

Fifteen ongoing line-item construction projects:

- Critical Utilities Rehabilitation Project at BNL;
- Seismic and Safety Modernization at LBNL;
- CEBAF Renovation and Expansion at TJNAF;
- Craft Resources Support Facility at ORNL;
- Large Scale Collaboration Center at SLAC;
- Tritium System Demolition and Disposal at PPPL;
- Argonne Utilities Upgrade at ANL;
- Linear Assets Modernization Project at LBNL;
- Critical Utilities Infrastructure Revitalization at SLAC;
- Utilities Infrastructure Project at FNAL;
- Science User Support Center at BNL;
- Translational Research Capability at ORNL;
- Biological and Environmental Program Integration Center (BioEPIC) at LBNL;
- Energy Sciences Capability project at PNNL; and,
- Integrated Engineering Research Center at FNAL.

Princeton Plasma Innovation Center, PPPL

The Princeton Plasma Innovation Center (PPIC) will provide a multi-purpose facility to PPPL, with laboratory and office space to support the Office of Science mission and fulfill the research needs of the Fusion Energy Sciences (FES), Advanced Scientific Computing Research (ASCR), and Basic Energy Sciences (BES) programs.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on September 9, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the fourth quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is \$65,500,000 to \$109,000,000 and the preliminary Total Project Cost (TPC) range of \$68,000,000 to \$111,500,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Critical Infrastructure Recovery & Renewal, PPPL

The Critical Infrastructure Recovery & Renewal (CIRR) project at PPPL will revitalize critical infrastructure that supports the PPPL campus. Upgrades that may be completed as part of the CIRR project include: the electrical distribution system; standby power; chilled water generation and distribution; distribution networks for steam, compressed air, sanitary waste, and condenser, storm, canal, and potable water; HVAC systems; and communication systems.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on September 16, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the second quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is \$48,900,000 to \$80,400,000. The preliminary Total Project

Cost (TPC) range for this project is \$50,400,000 to \$81,900,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Ames Infrastructure Modernization, Ames

The Ames Infrastructure Modernization (AIM) project will support the SC mission by providing a safer and more operationally efficient campus for the employees, visitors, and guests at Ames, as well as reduce deferred maintenance costs. This project is designed to support DOE mission-critical programs and initiatives, increase the reliability of utility infrastructure, minimize facility costs through effective and efficient operations, and modernize laboratories in Ames Laboratory's research buildings, thereby enhancing Ames Laboratory's ability to continue to deliver on SC's mission across multiple program offices.

Specifically, this project will provide updated infrastructure building systems in existing research and operations buildings at Ames Laboratory, such as plumbing systems; building envelopes; electrical systems-emergency, backup power, and uninterruptible power supplies; and telecommunication systems. In addition, some of the laboratory spaces will be modernized to support the SC mission and associated equipment.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on September 16, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the third quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is \$21,000,000 to \$88,000,000. The preliminary Total Project Cost (TPC) range for this project is \$23,000,000 to \$90,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Critical Utilities Rehabilitation Project, BNL

The Critical Utilities Rehabilitation Project at BNL will revitalize and upgrade highest risk major utility systems to meet the needs of supporting SC facilities and Nuclear Physics (NP), Basic Energy Sciences (BES), High Energy Physics (HEP), Biological and Environmental Research (BER), and Advanced Scientific Computing Research (ASCR) program missions.

Specifically, this project will replace piping in areas prone to water main breaks and provide other water system improvements to improve system operations and reliability. Select sections of the sanitary utility systems with failing pumps, controllers, and/or manholes will be replaced. This project will also provide several required modifications to the central chilled water system in order to support growth of process loads and ensure reliability. Deteriorated and leaking steam systems along Cornell Avenue will be replaced to ensure safe, reliable, and efficient steam service to mission-critical facilities on the north side of the campus. In addition, older feeder cables and inadequate breakers will be replaced along Cornell Avenue, increasing capacity, reliability and personnel safety.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on July 20, 2018. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the second quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is \$70,000,000 to \$92,000,000. The preliminary TPC range for this project is \$70,800,000 to \$92,800,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Seismic and Safety Modernization, LBNL

The Seismic and Safety Modernization project will address seismic safety issues and emergency response capabilities, specifically related to facilities with large congregation areas as well as improve facilities that are necessary for emergency response personnel and to maintain continuity of operations. The facilities that are the primary focus of this project are the Cafeteria, Health Services, and Fire House sleeping quarters.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, approved on September 4, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the third quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$65,600,000 to \$95,400,000 and the preliminary TPC range of \$67,800,000 to \$97,600,000. These

cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is \$95,400,000 and the preliminary TPC point estimate for this project is \$97,600,000.

CEBAF Center Renovation and Expansion, TJNAF

The CEBAF Renovation and Expansion project will renovate existing space and provide new research, administrative, and support service space enabling TJNAF to better support SC missions. The CEBAF center at TJNAF is currently overcrowded and has inadequate utility systems that are experiencing frequent failures. This project will renovate 123,000 to 250,000 gross square feet (gsf) of existing space in the CEBAF center and the Applied Research Center (ARC), upgrade high risk utility systems, and provide 82,000 to 150,000 gsf of additional space for visitors, users, research, education, and support.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on July 20, 2018. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the first quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$47,000,000 to \$96,000,000 and a preliminary TPC range of \$48,900,000 to \$99,300,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Craft Resources Support Facility, ORNL

The Craft Resources Support Facility project will relocate and consolidate craft resource services that are currently housed in multiple, inadequate facilities spread across the campus in the 7000 area. ORNL supports the mission work of all six of SC's research program offices and three scientific user facilities. The complex infrastructure required to support the SC mission and associated one-of-a-kind large scale facilities places a substantial demand on craft resource support functions, which is comprised of 28 different trades ranging from automotive mechanics to instrument technicians. Craft resource support services are currently housed in multiple facilities spread across the 7000 campus area which are outdated and poorly configured resulting in inefficient operations, congested vehicle and pedestrian traffic patterns, and increased safety risks. These conditions are creating inefficient, and unreliable operations, which are directly impacting many high-priority SC programs at ORNL.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on July 20, 2018. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the second quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$34,000,000 to \$48,000,000 and a preliminary TPC range of \$35,000,000 to \$49,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Large Scale Collaboration Center, SLAC

The Large Scale Collaboration Center project will construct a multi-office building of approximately 38,000 to 45,000 gsf to consolidate and provide space for 100-150 occupants in a common building, provide synergies among all major SC-sponsored programs at SLAC, and provide a centralized office and collaboration space for cross-functional teams with the necessary performance capabilities to grow the science research programs. With the growth in SC mission activities at SLAC – from the Linac Coherent Light Source (LCLS), LCLS-II, LCLS-II-HE projects to Facility for Advanced Accelerator Experimental Tests (FACET)-II and the Matter in Extreme Conditions project – the lab currently lacks office spaces for scientists and staff as current spaces are fully occupied or oversubscribed, and therefore do not support the needs for joint collaborations for exploring challenges and developing solutions using large-scale data sets. Adjacent office spaces that enable researchers to benefit from collaboration with subject matter experts in computational science, machine learning, artificial intelligence, exascale computing, data management, data acquisition, simulation, imaging, visualization, and modeling are also not currently available.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, approved on November 18, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the first quarter of FY 2022. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$56,000,000 to \$90,400,000 and a preliminary TPC range of \$59,400,000 to \$92,400,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is \$64,000,000 and the preliminary TPC point estimate for this project is \$66,000,000.

Tritium System Demolition and Disposal, PPPL

The Tritium System Demolition and Disposal (TSDD) project at PPPL will remove tritium-contaminated items, components, equipment, sub-systems, etc., through demolition and disposal off-site. Execution of the TSDD project will result in reducing the risk of tritium release, reducing the risk of worker exposure to tritium, and reducing operating dollars expended on a legacy system.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on September 16, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the fourth quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is \$19,500,000 to \$32,400,000. The preliminary Total Project Cost (TPC) range for this project is \$20,500,000 to \$33,400,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Argonne Utilities Upgrade, ANL

The Argonne Utilities Upgrade project at ANL is proposed to revitalize and selectively upgrade ANL's existing major utility systems including steam, water, sanitary sewer, chilled water, and electrical systems.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the fourth quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary Total Estimated Cost (TEC) range for this project is \$72,000,000 to \$215,000,000. The preliminary Total Project Cost (TPC) range for this project is \$73,000,000 to \$216,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Linear Assets Modernization Project, LBNL

The Linear Assets Modernization Project at LBNL is proposed to upgrade high priority utility systems to increase the reliability, capability, and safety of LBNL's infrastructure to meet the DOE's mission. The project will upgrade utility systems including, but not limited to, domestic water, natural gas, storm drain, sanitary sewer, electrical, and communication.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the fourth quarter of FY 2020. This project is pre-CD-2, therefore schedule estimates are preliminary and subject to change. The preliminary Total Estimated Cost (TEC) range for this project is \$142,000,000 to \$236,000,000. The preliminary Total Project Cost (TPC) range for this project is \$146,000,000 to \$240,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Critical Utilities Infrastructure Revitalization, SLAC

The primary objective of CUIR is to close infrastructure gaps to support multi-program science missions as technologies, instruments, experimental parameters, sensitivities, and complexity associated with evolving science demand increases required reliability, resiliency, and service levels in electrical, mechanical, and civil systems site wide. The CUIR project will address the critical campus-wide utility and infrastructure issues by replacing, repairing, and modernizing the highest risk water/fire protection, sanitary sewer, storm drain, electrical, and cooling water system deficiencies. Subject matter experts responsible for stewardship of the systems have identified these needs through condition assessments, inspections, and recommendations.

The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, approved May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the fourth quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary Total Estimated Cost (TEC) range for this project is \$80,000,000 to \$186,000,000. The preliminary Total Project Cost (TPC) range for this project is \$83,000,000 to \$189,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Utilities Infrastructure Project, FNAL

The Utilities Infrastructure Project at FNAL will identify, recapitalize, and upgrade the highest risk major utility systems across the FNAL campus. Specifically, this project will evaluate the current condition of the industrial cooling water system, potable water distribution system, sanitary sewer and storm collection systems, natural gas distribution system, electrical distribution system, and the Central Utility Building. Selected portions of the systems will be recapitalized or replaced to assure safe, reliable, and efficient service to mission critical facilities. In addition, upgrades to obsolete, end-of-life components will increase capacity, reliability, and personnel safety for critical utilities.

The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, approved on May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the first quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is \$146,000,000 to \$310,000,000 and the preliminary Total Project Cost (TPC) range of \$150,000,000 to \$314,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

Science User Support Center, BNL

Construction of the Science User Support Center will provide convenient and efficient facilities for processing and supporting the users of BNL's premier research facilities by replacing the current dispersed and inefficient facilities. It will also provide conference facilities to support the collaborative science and research agenda for the user community and BNL scientists. BNL user facilities and capabilities supported by DOE and partnering agencies attract over 40,000 visiting scientists, guests, users, and contractors annually to conduct research in a broad range of basic and applied sciences. However, the ability to efficiently process and support the needs of this growing community of researchers is limited by the age, deteriorated condition, and dispersed nature of BNL's current facilities.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, approved on December 18, 2018. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the fourth quarter of FY 2020. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$70,800,000 to \$94,800,000. The preliminary total TPC range for this project is \$72,000,000 to \$96,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is \$85,000,000 and the preliminary TPC point estimate for this project is \$86,200,000.

Translational Research Capability, ORNL

The Translational Research Capability project is proposed to provide a new building with laboratory space to support mission-critical research sponsored by ASCR, BES, FES and HEP. Currently, ORNL has a shortage of modern, flexible, and adaptable space, wet and dry laboratories, and high bay space needed to support research directed by these SC programs. Aging infrastructure and utilities have caused severe temperature, humidity and power quality problems, particularly in the advanced materials development and research. Finally, dispersed research space across the ORNL campus remains a challenge in supporting the increasingly interdisciplinary and collaborative research required to advance SC program mission areas.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-3A, Approve Long-Lead Procurements and Start of Early Construction Activities, approved on February 5, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the third quarter of FY 2020. This project is pre-CD-2, therefore schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$80,300,000 to \$93,500,000 and a preliminary TPC range of \$81,800,000 to \$95,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is \$93,500,000 and the preliminary TPC point estimate for this project is \$95,000,000.

Biological and Environmental Program Integration Center (BioEPIC), LBNL

The BioEPIC project will construct a new, state-of-the-art facility with laboratory space to support high performance research by the BER, ASCR and BES programs. LBNL has grown from a pioneering particle and nuclear physics laboratory into a multidisciplinary research facility with broad capabilities in physical, chemical, computational, biological, and

environmental systems research in support of the DOE mission. Much of the biological sciences program at LBNL is located off-site and away from the main laboratory and other parts are dispersed across several locations on the LBNL campus. This arrangement has posed a challenge to research and operational capabilities limiting scientific progress and the kind of collaborative science that is required for understanding, predicting, and harnessing the Earth's microbiome for energy and environmental benefits.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, approved on May 9, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the fourth quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$110,000,000 to \$190,000,000 and a preliminary TPC range of \$112,200,000 to \$192,200,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is \$140,000,000 and the preliminary TPC point estimate for this project is \$142,200,000.

Energy Sciences Capability, PNNL

The Energy Sciences Capability project will enhance PNNL's core fundamental science programs by addressing many infrastructure capability gaps, including insufficient hood space for catalysis synthesis and collaboration, lack of proper environmental controls for state-of-the-art in situ characterization, limited space to integrate experimental capabilities for visualization supporting research in data analytics, modeling, and simulation, and performance modeling (for the Center for Advanced Technology Evaluation/ASCR related capability), and limited collaboration space for users and strategic partners.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-2/3, Approve Project Performance Baseline and Approve Start of Construction, approved on December 7, 2018. The preliminary estimate for CD-4, Approve Start of Operations or Project Completion, is anticipated in the fourth quarter of FY 2023. The Total Estimated Cost (TEC) for this project is \$90,000,000. The Total Project Cost (TPC) for this project is \$93,000,000.

Integrated Engineering Research Center, FNAL

The Integrated Engineering Research Center project will construct a scientific user support facility to accommodate increased collaboration and interactions among staff at FNAL, who will in turn be working with scientific collaborators and international partners in the design, construction, and operation of physics experiments. Currently, FNAL staff and their associated manufacturing, assembly, engineering, and technical facilities are scattered among three parts of the campus. As a result, they are unable to efficiently collaborate on ongoing and planned projects in support of the mission of the laboratory. The Integrated Engineering Research Center will provide FNAL with a collaborative, multi-divisional and interdisciplinary research center, will reduce the overall footprint of outdated facilities and collocate engineering and associated research staff near the central campus, and will improve operational efficiency and collaboration because groups working on key projects would be in close proximity.

The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-3A, Approve Long Lead Procurement, which was approved on July 16, 2019. The preliminary estimate for CD-2/3, Approve Project Baseline and Approve Start of Construction Activities, is anticipated in the fourth quarter of FY 2020. This project is pre-CD-2, therefore schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of \$73,000,000 to \$98,000,000. The TPC range for this project is \$74,000,000 to \$99,000,000. The preliminary TEC point estimate for this project is \$85,000,000 and the preliminary TPC point estimate for this project is \$86,000,000.

**Science Laboratories Infrastructure
Construction**

Activities and Explanation of Changes

(dollars in thousands)

FY 2020 Enacted	FY 2021 Request	Explanation of Changes FY 2021 Request vs FY 2020 Enacted
Construction	\$208,000	\$151,400
		-\$56,600
21-SC-71, Princeton Plasma Innovation Center, PPPL	\$—	\$2,000
No funding was appropriated.	The Request will initiate Project Engineering and Design (PED) activities.	The increase will support the initiation of PED activities for this new project.
21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL	\$—	\$2,000
No funding was appropriated.	The Request will initiate PED activities.	The increase will support the initiation of PED activities for this new project.
21-SC-73, Ames Infrastructure Modernization	\$—	\$2,000
No funding was appropriated.	The Request will initiate PED activities.	The increase will support the initiation of PED activities for this new project.
20-SC-71, Critical Utilities Rehabilitation Project, BNL	\$20,000	\$15,000
Funding supports the initiation of PED and construction activities.	The Request will support construction activities.	Funding will support ongoing construction activities for this project.
20-SC-72, Seismic and Safety Modernization, LBNL	\$10,000	\$10,000
Funding fully supports PED activities for this project.	The Request will initiate construction activities.	Funding initiates construction activities for this project.

(dollars in thousands)

FY 2020 Enacted	FY 2021 Request	Explanation of Changes FY 2021 Request vs FY 2020 Enacted
20-SC-73, CEBAF Renovation and Expansion, TJNAF \$2,000	\$2,000	\$—
Funding initiates PED activities for this project.	The Request will support ongoing PED activities.	Funding continues ongoing PED activities for this project.
20-SC-74, Craft Resources Support Facility, ORNL \$15,000	\$25,000	+\$10,000
Funding initiates PED and construction activities for this project.	The Request will support ongoing construction activities.	Requested funding will provide final funding for this project.
20-SC-75, Large Scale Collaboration Center, SLAC \$11,000	\$8,000	-\$3,000
Funding initiates PED and construction activities for this project.	The Request will support ongoing construction activities.	Funding supports ongoing construction for this project.
20-SC-76, Tritium System Demolition and Disposal, PPPL \$13,000	\$19,400	+\$6,400
Funding initiates PED and construction activities.	The Request will support ongoing construction activities.	Increase provides final funding for this project and supports ongoing construction.
20-SC-77, Argonne Utilities Upgrade, ANL \$500	\$2,000	+\$1,500
Funding initiates PED activities.	The Request will support ongoing PED activities.	The increase will provide funding to support ongoing PED activities for this project.
20-SC-78, Linear Assets Modernization, LBNL \$500	\$2,000	+\$1,500
Funding initiates PED activities.	The Request will support ongoing PED activities.	The increase will provide funding to support ongoing PED activities for this project.
20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC \$500	\$2,000	+\$1,500
Funding initiates PED activities.	The Request will support ongoing PED activities.	The increase will provide funding to support ongoing PED activities for this project.

(dollars in thousands)

FY 2020 Enacted	FY 2021 Request	Explanation of Changes FY 2021 Request vs FY 2020 Enacted
20-SC-80, Utilities Infrastructure Project, FNAL \$500	\$2,000	+\$1,500
Funding initiates PED activities.	The Request will support ongoing PED activities.	The increase will support ongoing PED activities for this project.
19-SC-71, Science User Support Center, BNL \$20,000	\$7,000	-\$13,000
Funding supports the completion of PED activities and start of construction activities.	The Request will support construction activities.	Funding supports ongoing construction activities for this project.
19-SC-72, Electrical Capacity and Distribution Capability, ANL \$30,000	\$—	-\$30,000
Funding supports the completion of construction activities.	No funding is requested.	Final funding was provided in FY 2020 for this project.
19-SC-73, Translational Research Capability, ORNL \$25,000	\$10,000	-\$15,000
Funding supports construction activities.	The Request will support construction activities.	Funding will support ongoing construction activities for this project.
19-SC-74, BioEPIC, LBNL \$15,000	\$6,000	-\$9,000
Funding supports the completion of PED activities and start of construction activities.	The Request will support construction activities	Funding supports ongoing construction activities for this project.
18-SC-71, Energy Sciences Capability, PNNL \$23,000	\$23,000	\$—
Funding supports construction activities.	The Request will support the completion of construction activities.	Requested funding will provide final funding for this project.
17-SC-71, Integrated Engineering Research Center, FNAL \$22,000	\$12,000	-\$10,000
Funding supports construction activities.	The Request will support construction activities.	Funding supports ongoing construction activities for this project.

**Science Laboratories Infrastructure
Capital Summary**

(dollars in thousands)

Capital Operating Expenses

	Total	Prior Years	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
Minor Construction Activities						
General Plant Projects (GPP)	N/A	N/A	13,188	38,578	6,000	-32,578
Institutional General Plant Projects (IGPP)	N/A	N/A	86,408	87,835	85,450	-2,385
Total, Capital Operating Expenses	N/A	N/A	99,596	126,413	91,450	-34,963

Minor Construction Activities

(dollars in thousands)

General Plant Projects (GPP)

	Total	Prior Years	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
Greater than or equal to \$5M and less than \$20M						
Cooling Water Tower System at SLAC	N/A	N/A	9,400	—	—	—
Accelerated PFAS Source Area Groundwater Characterization and Remediation at BNL	N/A	N/A	—	10,900	—	-10,900
Grizzly Substation Yard Expansion at LBNL	N/A	N/A	—	15,000	—	-15,000
Village Sanitary Improvements/Lift Station at FNAL	N/A	N/A	—	6,000	—	-6,000
Cryogenics Test Facility (CTF) Upgrade at TJNAF	N/A	N/A	—	5,200	—	-5,200
Total GPPs (greater than or equal to \$5M and less than \$20M)	N/A	N/A	9,400	37,100	—	-37,100
Total GPPs less than \$5M	N/A	N/A	3,788	1,478	6,000	+4,522
Total, General Plant Projects (GPP)^a	N/A	N/A	13,188	38,578	6,000	-32,578

^a GPP activities less than \$5M include design and construction for additions and/or improvements to land, buildings, replacements or additions to roads, and general area improvements.

(dollars in thousands)

	Total	Prior Years	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
Institutional General Plant Projects (IGPP)						
Greater than or equal to \$5M and less than \$20M						
Bayview Site Utility Replacement Project at LBNL	N/A	N/A	8,500	—	—	—
Sitewide Electrical Safety and Maintenance Upgrades Phase 1 at LBNL	N/A	N/A	17,800	—	—	—
Sitewide Mechanical Plant Maintenance Upgrades Phase 1 at LBNL	N/A	N/A	17,150	—	—	—
7000 Area Storage at ORNL	N/A	N/A	6,330	—	—	—
7000 Area Utility Modernization at ORNL	N/A	N/A	7,600	—	—	—
4500N General Use Office Space at ORNL	N/A	N/A	5,850	—	—	—
2000/3000 Area Utility Modernization at ORNL	N/A	N/A	9,200	—	—	—
Building 6010 Generic Research & Office Swing- space Buildout at ORNL	N/A	N/A	9,000	—	—	—
B77 Enclosure Installation at LBNL	N/A	N/A	—	5,150	—	-5,150
B77 Engineering Facility Capabilities Modernization at LBNL	N/A	N/A	—	6,000	—	-6,000
B73 Seismic Upgrade and Modernization at LBNL	N/A	N/A	—	12,615	—	-12,615
Transit Hub and Utility Improvements at LBNL	N/A	N/A	—	14,865	—	-14,865
Secondary Sewage Treatment Upgrade at ORNL	N/A	N/A	—	19,000	—	-19,000
Centennial Bridge Replacement at LBNL	N/A	N/A	—	—	13,000	+13,000
Grizzly Substation Upgrade at LBNL	N/A	N/A	—	—	18,500	+18,500
General Purpose Data Center Expansion at LBNL	N/A	N/A	—	—	16,000	+16,000
Total IGPPs (greater than or equal to \$5M and less than \$20M)	N/A	N/A	81,430	57,630	47,500	-10,130
Total IGPPs less than \$5M	N/A	N/A	4,978	30,205	37,950	+7,745
Total, Institutional General Plant Projects (IGPP)^a	N/A	N/A	86,408	87,835	85,450	-2,385
Total, Direct Funded Minor Construction	N/A	N/A	13,188	38,578	6,000	-32,578
Total, Indirect Funded Minor Construction	N/A	N/A	86,408	87,835	85,450	-2,385
Total, Minor Construction Activities	N/A	N/A	99,596	126,413	91,450	-34,963

^a Institutional General Plant Projects (IGPPs) are indirect funded minor construction activities that are general institutional in nature and address general purpose, site-wide needs.

**Science Laboratories Infrastructure
Construction Projects Summary**

(dollars in thousands)

	Total	Prior Years	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
21-SC-71, Princeton Plasma Innovation Center, PPPL						
TEC	109,000 ^a	—	—	—	2,000	+2,000
OPC ^b	2,500	—	300	2,000	—	-2,000
TPC	111,500^a	—	300	2,000	2,000	—
21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL						
TEC	80,400 ^a	—	—	—	2,000	+2,000
OPC ^b	1,500	—	100	1,200	—	-1,200
TPC	81,900^a	—	100	1,200	2,000	+800
21-SC-73 Ames Infrastructure Modernization						
TEC	30,000 ^a	—	—	—	2,000	+2,000
OPC ^b	1,000	—	—	250	250	—
TPC	31,000^a	—	—	250	2,250	+2,000
20-SC-71, Critical Utilities Rehabilitation Project, BNL						
TEC	92,000 ^a	—	—	20,000	15,000	-5,000
OPC ^b	800	—	800	—	—	—
TPC	92,800^a	—	800	20,000	15,000	-5,000
20-SC-72, Seismic and Safety Modernization, LBNL						
TEC	95,400 ^a	—	—	10,000	10,000	—
OPC ^b	2,200	—	1,500	100	—	-100
TPC	97,600^a	—	1,500	10,100	10,000	-100

^a This project has not received CD-2 approval; therefore, preliminary estimates are shown for TEC and TPC.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Total	Prior Years	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
20-SC-73, CEBAF Renovation and Expansion, TJNAF						
TEC	87,000 ^a	—	—	2,000	2,000	—
OPC ^b	2,300	—	1,000	700	—	-700
TPC	89,300^a	—	1,000	2,700	2,000	-700
20-SC-74, Craft Resources Support Facility, ORNL						
TEC	40,000 ^a	—	—	15,000	25,000	+10,000
OPC ^b	1,000	—	800	—	—	—
TPC	41,000^a	—	800	15,000	25,000	+10,000
20-SC-75, Large Scale Collaboration Center, SLAC						
TEC	64,000 ^a	—	—	11,000	8,000	-3,000
OPC ^b	2,000	—	500	200	1,300	+1,100
TPC	66,000^a	—	500	11,200	9,300	-1,900
20-SC-76, Tritium System Demolition and Disposal, PPPL						
TEC	32,400 ^a	—	—	13,000	19,400	+6,400
OPC ^b	1,000	—	100	800	100	-700
TPC	33,400^a	—	100	13,800	19,500	+5,700
20-SC-77, Argonne Utilities Upgrade, ANL						
TEC	215,000 ^a	—	—	500	2,000	+1,500
OPC ^b	1,000	—	100	600	300	-300
TPC	216,000^a	—	100	1,100	2,300	+1,200

^a This project has not received CD-2 approval; therefore, preliminary estimates are shown for TEC and TPC.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Total	Prior Years	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
20-SC-78, Linear Assets Modernization Project, LBNL						
TEC	236,000 ^a	—	—	500	2,000	+1,500
OPC ^b	4,000	—	300	1,700	—	-1,700
TPC	240,000^a	—	300	2,200	2,000	-200
20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC						
TEC	186,000 ^a	—	—	500	2,000	+1,500
OPC ^b	3,000	—	—	1,000	1,000	—
TPC	189,000^a	—	—	1,500	3,000	+1,500
20-SC-80, Utilities Infrastructure Project, FNAL						
TEC	310,000 ^a	—	—	500	2,000	+1,500
OPC ^b	4,000	—	100	1,900	—	-1,900
TPC	314,000^a	—	100	2,400	2,000	-400
19-SC-71, Science User Support Center, BNL						
TEC	85,000 ^a	—	7,000	20,000	7,000	-13,000
OPC ^b	1,200	1,000	200	—	—	—
TPC	86,200^a	1,000	7,200	20,000	7,000	-13,000
19-SC-72, Electrical Capacity and Distribution Capability, ANL						
TEC	60,000 ^a	—	30,000	30,000	—	-30,000
OPC ^b	1,000	—	—	—	—	—
TPC	61,000^a	—	30,000	30,000	—	-30,000

^a This project has not received CD-2 approval; therefore, preliminary estimates are shown for TEC and TPC.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Total	Prior Years	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
19-SC-73, Translational Research Capability, ORNL						
TEC	93,500 ^a	—	25,000	25,000	10,000	-15,000
OPC ^b	1,500	1,190	210	—	—	—
TPC	95,000^a	1,190	25,210	25,000	10,000	-15,000
19-SC-74, BioEPIC, LBNL						
TEC	140,000 ^a	—	5,000	15,000	6,000	-9,000
OPC ^b	2,200	—	1,500	—	—	—
TPC	142,200^a	—	6,500	15,000	6,000	-9,000
18-SC-71, Energy Sciences Capability, PNNL						
TEC	90,000	20,000	24,000	23,000	23,000	—
OPC ^b	3,000	1,236	—	—	—	—
TPC	93,000	21,236	24,000	23,000	23,000	—
17-SC-71, Integrated Engineering Research Center, FNAL						
TEC	85,000 ^a	22,500	20,000	22,000	12,000	-10,000
OPC ^b	1,000	930	—	—	—	—
TPC	86,000^a	23,430	20,000	22,000	12,000	-10,000
17-SC-73, Core Facility Revitalization, BNL						
TEC	74,000	31,800	42,200	—	—	—
OPC ^b	850	850	—	—	—	—
TPC	74,850	32,650	42,200	—	—	—
Total, Construction						
TEC	N/A	N/A	153,200	208,000	151,400	-56,600
OPC ^b	N/A	N/A	7,410	10,450	2,950	-7,500
TPC	N/A	N/A	160,610	218,450	154,350	-64,100

^a This project has not received CD-2 approval; therefore, preliminary estimates are shown for TEC and TPC.

^b Other Project Costs (OPC) are funded through laboratory overhead.

**Science Laboratories Infrastructure
Funding Summary**

(dollars in thousands)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted
Projects	153,200	208,000	151,400	-56,600
Other	79,690	93,000	22,710	-70,290
Total, Science Laboratories Infrastructure	232,890	301,000	174,110	-126,890

**21-SC-71, Princeton Plasma Innovation Center
Princeton Plasma Physics Laboratory (PPPL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Princeton Plasma Innovation Center (PPIC) project is \$2,000,000. This project has a preliminary Total Estimated Cost (TEC) range of \$65,500,000 to \$109,000,000 and a preliminary Total Project Cost (TPC) range of \$68,000,000 to \$111,500,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$111,500,000.

This project will provide a multi-purpose facility with modern, flexible, efficient, and agile research laboratories and office space to conduct plasma research activities in support of multiple SC programs.

Significant Changes

This project is a new start in FY 2021. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved September 9, 2019. FY 2021 funds will initiate Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

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	9/09/19	N/A	4Q FY 2020 ^a	2Q FY 2022 ^a	N/A	2Q FY 2023 ^a	N/A	4Q FY 2029 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	N/A	2Q FY 2022 ^a

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

^aThis project is pre-CD-2 approval: therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC^a, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	9,000	100,000 ^b	109,000	2,500	N/A	2,500	111,500 ^b

2. Project Scope and Justification

Scope

The Princeton Plasma Innovation Center (PPIC) is envisioned as a 67,000 to 84,000 gross square feet (gsf) multi-story office and laboratory building at Princeton Plasma Physics Laboratory (PPPL) to serve as a single new multi-use facility that will house space for offices, medium bay research labs for diagnostics and fabrication, remote participation and collaboration, and research support.

Justification

In order to advance the plasma science and fusion frontier in support of the DOE mission, PPPL requires new or enhanced facilities and infrastructure to foster innovation to make fusion energy a practical reality and further U.S. economic competitiveness. The primary SC program relevant to the PPIC project is Fusion Energy Sciences (FES), and the primary Core Capability is Plasma and Fusion Energy Sciences. The missions of SC's Advanced Scientific Computing Research and Basic Energy Sciences programs are also relevant to the mission need for the PPIC with second order effect to Large Scale User Facilities/Advanced Instrumentation and Systems Engineering and Integration.

PPPL is a United States DOE national laboratory operated by Princeton University, and plays a key role in assisting FES achieve its strategic goals. The PPPL vision is "enabling a world powered by safe, clean, and plentiful fusion energy while leading discoveries in plasma science and technology." To support this vision, PPPL carries out experiments and computer simulations of the behavior of plasma, which is hot electrically-charged gas. Plasmas with sufficient temperature generate fusion reactions. Therefore, PPPL's aim is to be a leading center for future fusion concepts. The understanding of plasma and its related technologies also has a broad impact on many other scientific fields and applications that are central to U.S. economic health and competitiveness. This impact extends to astrophysics and space sciences, plasma-material interactions, plasma processing, particle acceleration, and high energy density plasmas. Many industries, such as the microelectronics industry, utilize plasmas to synthesize and shape the materials in their products. These industries are increasingly seeking collaboration with PPPL to improve their understanding of existing plasma processes and to develop new modeling and measurement techniques potentially leading to new processes and applications. PPPL, in collaboration with Princeton University, is strengthening its efforts to develop innovations for the next generation microelectronics to advance economic competitiveness, national security, and future energy applications.

However, the current condition, capabilities, and configuration of PPPL infrastructure do not support current or planned scientific efforts, in particular, the lack of adequate laboratory infrastructure, modern collaboration space, and modern office infrastructure. PPPL would benefit from office and laboratories capabilities that can effectively accomplish the advancement of the FES mission.

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*.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Multi-Story Building	67,000 gsf	84,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	2,000	2,000	2,000
Outyears	7,000	7,000	7,000
Total, Design	9,000	9,000	9,000
Construction			
Outyears	100,000	100,000	100,000
Total, Construction	100,000	100,000	100,000
Total Estimated Cost (TEC)			
FY 2021	2,000	2,000	2,000
Outyears	107,000	107,000	107,000
Total, TEC^a	109,000	109,000	109,000
Other Project Cost (OPC)			
FY 2019	300	300	11
FY 2020	2,000	2,000	2,289
Outyears	200	200	200
Total, OPC^b	2,500	2,500	2,500
Total Project Cost (TPC)			
FY 2019	300	300	11
FY 2020	2,000	2,000	2,289
FY 2021	2,000	2,000	2,000
Outyears	107,200	107,200	107,200
Total, TPC^a	111,500	111,500	111,500

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	7,500	N/A	N/A
Contingency	1,500	N/A	N/A
Total, Design	9,000	N/A	N/A
Construction			
Construction	83,300	N/A	N/A
Contingency	16,700	N/A	N/A
Total, Construction	100,000	N/A	N/A
Total, TEC^a	109,000	N/A	N/A
<i>Contingency, TEC</i>	<i>18,200</i>	<i>N/A</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
Conceptual Planning	300	N/A	N/A
Conceptual Design	2,000	N/A	N/A
Contingency	200	N/A	N/A
Total, OPC	2,500	N/A	N/A
<i>Contingency, OPC</i>	<i>200</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^a	111,500	N/A	N/A
Total, Contingency (TEC+OPC)	18,400	N/A	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2021	TEC	—	—	2,000	107,000	109,000 ^a
	OPC ^b	300	2,000	—	200	2,500
	TPC	300	2,000	2,000	107,200	111,500 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2029
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2079

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs ^a	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	TBD	N/A	TBD
Utilities	N/A	TBD	N/A	TBD
Maintenance and Repair	N/A	TBD	N/A	TBD
Total, Operations and Maintenance	N/A	TBD	N/A	TBD

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Princeton Plasma Physics Laboratory	67,000-84,000
Area of D&D in this project at Princeton Plasma Physics Laboratory	13,400
Area at Princeton Plasma Physics Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None ^b
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	13,400

8. Acquisition Approach

The PPPL Management and Operating (M&O) Contractor, Princeton University, will perform the acquisition for this project, overseen by the Princeton Site Office. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. It will evaluate various acquisition and project delivery methods prior to achieving CD-1 and potential benefits of using single or multiple contracts to procure materials, equipment, construction, commissioning and other project scope elements. The M&O Contractor's annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

^a Life-Cycle costs will be performed as part of CD-1.

^b With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**21-SC-72, Critical Infrastructure Recovery & Renewal (CIRR)
Princeton Plasma Physics Laboratory (PPPL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Critical Infrastructure Recovery & Renewal (CIRR) project is \$2,000,000. The current preliminary Total Estimated Cost (TEC) range for this project is \$48,900,000 to \$80,400,000. The preliminary Total Project Cost (TPC) range for this project is \$50,400,000 to \$81,900,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$81,900,000.

PPPL’s aging utility infrastructure is non-redundant and increasingly unreliable, which negatively impacts lab operations. Scientific productivity is dependent on a capable, available, flexible, maintainable, and reliable support infrastructure. This project will provide critical infrastructure needed to safely and efficiently operate the laboratory missions. These systems will be modern and energy efficient, reducing the operating cost of the facility.

Significant Changes

This project is a new start in FY 2021. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on September 16, 2019. FY 2021 funds will initiate Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

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	9/16/19	N/A	2Q FY 2020 ^a	4Q FY 2022 ^a	4Q FY 2023	4Q FY 2023 ^a	N/A	4Q FY 2029 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2022 ^a	1Q FY 2023 ^a

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

^a This project is pre-CD-2 approval: therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	8,000	72,400 ^b	80,400	1,500	N/A	1,500	81,900 ^b

2. Project Scope and Justification

Scope

The CIRR project’s preliminary scope includes upgrades that may include: the electrical distribution system; standby power; chilled water generation and distribution; distribution networks for steam, compressed air, sanitary waste, and condenser, storm, canal, and potable water; HVAC systems; and communication systems.

Justification

Princeton Plasma Physics Laboratory (PPPL) is a significant element of the DOE capability in plasma science and directly supports the DOE mission to make fusion energy a practical reality and further U.S. economic competitiveness. In order to maintain system operability, it is essential to have reliable infrastructure in place. The current systems are outdated, at capacity, unreliable, and inefficient. Portions of the current system are part of the original infrastructure built in 1958. In order to maintain current missions and enable future ones, the infrastructure must be upgraded with modern, efficient, and reliable systems.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> ▪ Rehabilitate and selectively upgrade PPPL’s existing major utility systems 	<ul style="list-style-type: none"> ▪ Renovate select electrical generation and distribution systems and components ▪ Renovate chilled water facility ▪ Renovate select building HVAC equipment ▪ Renovate select data and communication systems ▪ Renovate select sections steam piping and components ▪ Renovate select sections of sanitary/storm water system 	<ul style="list-style-type: none"> ▪ Replace additional electrical distribution system components ▪ Replace additional building HVAC equipment ▪ Replace additional sections of underground piping

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval; therefore, funding estimates are preliminary.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	2,000	2,000	2,000
Outyears	6,000	6,000	6,000
Total, Design	8,000	8,000	8,000
Construction			
Outyears	72,400	72,400	72,400
Total, Construction	72,400	72,400	72,400
Total Estimated Cost (TEC)			
FY 2021	2,000	2,000	2,000
Outyears	78,400	78,400	78,400
Total, TEC^a	80,400	80,400	80,400
Other Project Cost (OPC)			
FY 2019	100	100	100
FY 2020	1,200	1,200	1,200
Outyears	200	200	200
Total, OPC^b	1,500	1,500	1,500
Total Project Cost (TPC)			
FY 2019	100	100	100
FY 2020	1,200	1,200	1,200
FY 2021	2,000	2,000	2,000
Outyears	78,600	78,600	78,600
Total, TPC^a	81,900	81,900	81,900

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	6,700	N/A	N/A
Contingency	1,300	N/A	N/A
Total, Design	8,000	N/A	N/A

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Construction			
Construction	60,300	N/A	N/A
Contingency	12,100	N/A	N/A
Total, Construction	72,400	N/A	N/A
Total, TEC^a	80,400	N/A	N/A
<i>Contingency, TEC</i>	<i>13,400</i>	<i>N/A</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
Conceptual Planning	100	N/A	N/A
Conceptual Design	1,200	N/A	N/A
Contingency	200	N/A	N/A
Total, OPC	1,500	N/A	N/A
<i>Contingency, OPC</i>	<i>200</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^a	81,900	N/A	N/A
Total, Contingency (TEC+OPC)	13,600	N/A	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2021	TEC	—	—	2,000	78,400	80,400 ^a
	OPC ^b	100	1,200	—	200	1,500
	TPC	100	1,200	2,000	78,600	81,900 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2025
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	N/A

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs ^a	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	TBD	N/A	TBD
Utilities	N/A	N/A	N/A	N/A
Maintenance and Repair	N/A	TBD	N/A	TBD
Total, Operations and Maintenance	N/A	TBD	N/A	TBD

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Princeton Plasma Physics Laboratory	None
Area of D&D in this project at Princeton Plasma Physics Laboratory	None
Area at Princeton Plasma Physics Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^b
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

8. Acquisition Approach

The PPPL Management and Operating (M&O) Contractor, Princeton University, will perform the acquisition for this project, overseen by the Princeton Site Office. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. It will evaluate various acquisition and project delivery methods prior to achieving CD-1 and potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning and other project scope elements. The M&O Contractor’s annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

^a Life-Cycle costs will be performed as part of CD-1.

^b With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**21-SC-73, Ames Infrastructure Modernization
Ames Laboratory
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Ames Infrastructure Modernization (AIM) project is \$2,000,000. This project has a preliminary Total Estimated Cost (TEC) range of \$21,000,000 to \$88,000,000 and a preliminary Total Project Cost (TPC) range of \$23,000,000 to \$90,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$31,000,000.

AIM’s objective is to support the SC mission by providing a safer and more operationally efficient campus for the employees, visitors, and guests at Ames, as well as to reduce deferred maintenance costs. This project is designed to support DOE mission-critical programs and initiatives, increase the reliability of utility infrastructure, minimize facility costs through effective and efficient operations, and modernize laboratories in Ames Laboratory’s research buildings, thereby enhancing Ames Laboratory’s ability to continue to deliver on SC mission across multiple program offices.

Significant Changes

This project is a new start in FY 2021. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved September 16, 2019. FY 2021 funds will initiate Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

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	9/16/19	4Q FY 2020	3Q FY 2021 ^a	3Q FY 2022 ^a	1Q FY 2023 ^a	2Q FY 2023 ^a	N/A	4Q FY 2026 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	3Q FY 2022	3Q FY 2022 ^a

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

^a This project is pre-CD-2 approval: therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC^a, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	3,000	27,000 ^b	30,000	1,000	N/A	1,000	31,000 ^b

2. Project Scope and Justification

Scope

The AIM project will provide updated infrastructure building systems in existing research and operations buildings at Ames Laboratory, such as: plumbing systems; building envelopes; electrical systems-emergency, backup power, and uninterruptible power supplies; and telecommunication systems. In addition, some existing laboratory spaces will be modernized to support the SC mission and associated equipment.

Justification

SC utilizes the capabilities of Ames Laboratory to execute three of SC's 24 core capabilities and the mission of multiple SC program offices, including research by the offices of Basic Energy Sciences, Advanced Scientific Computing Research, Biological and Environment Research, and to a lesser extent, Fusion Energy Sciences. These core capabilities are 1) Condensed Matter Physics and Materials Science, 2) Chemical and Molecular Science, and 3) Applied Materials Science and Engineering. Ames Laboratory is dedicated to creating materials, inspiring minds to solve problems, and addressing global challenges. Ames Laboratory provides SC with the ability for research in the discovery, synthesis, analysis, and use of new materials, novel chemistries, and transformational analytical tools. In pursuing its SC Mission to deliver scientific discoveries, Ames Laboratory invents materials with new physical and chemical functionalities, especially those that harness the potential of rare-earth elements, through creative and innovative synthesis techniques; determines novel physics and chemistry of quantum materials and molecules using instrumentation developed at Ames Laboratory; shares these materials and knowledge with partners and collaborates nationwide and worldwide to advance fundamental knowledge in physics, chemistry, and materials science; and promotes the applications of these materials for economic and national security through in-house activities and external collaborations.

The current condition of the building systems and infrastructure impedes the execution and advancement of the SC mission for the following reasons: 1) aging plumbing systems result in unplanned events such as sanitary sewer or major water leaks that lead to disruption of scientific operations, jeopardizing instrumentation, and presenting a safety and health risk to personnel; 2) deteriorating building envelopes negatively impact the SC mission through increased operational costs, elevated risk to research equipment, and a poor work environment for Ames Laboratory staff; 3) lack of an adequate electrical supply and distribution, including reliability during outages, places sensitive scientific equipment at risk of damage, prevents program expansion, and limits SC continued investment in state-of-the-art equipment and instrumentation; 4) inadequate telecommunication systems impede program expansion and limits SC investment in state-of-the-art equipment and instrumentation; and 5) limited amount of modern research laboratory space impacts SC mission through several outcomes, such as the inability to house state-of-the-art equipment and instrumentation; implement best safety management practices; create collaborative environments; and attract, recruit, and retain the scientific talent.

Therefore, to better accommodate the current and future DOE Office of Science mission, minimize disruptions to critical research activities, reduce risks to operations, and improve the safety and reliability, Ames Laboratory needs improved infrastructure systems and work spaces.

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*.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> ▪ Rehabilitate and selectively upgrade Ames’ existing major utility systems 	<ul style="list-style-type: none"> ▪ Replace and upgrade plumbing systems in research buildings ▪ Upgrade the building envelope on mission critical research buildings ▪ Replace two backup generators 	<ul style="list-style-type: none"> ▪ Improve emergency/backup power distribution systems ▪ Modernize 23,000 sf of wet and dry labs, and office space in research buildings

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2021	2,000	2,000	2,000
Outyears	1,000	1,000	1,000
Total, Design	3,000	3,000	3,000
Construction			
Outyears	27,000	27,000	27,000
Total, Construction	27,000	27,000	27,000
Total Estimated Cost (TEC)			
FY 2021	2,000	2,000	2,000
Outyears	28,000	28,000	28,000
Total, TEC^a	30,000	30,000	30,000
Other Project Cost (OPC)			
FY 2020	250	250	25
FY 2021	250	250	475
Outyears	500	500	500
Total, OPC^b	1,000	1,000	1,000
Total Project Cost (TPC)			
FY 2020	250	250	25
FY 2021	2,250	2,250	2,475
Outyears	28,500	28,500	28,500
Total, TPC^a	31,000	31,000	31,000

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	2,500	N/A	N/A
Contingency	500	N/A	N/A
Total, Design	3,000	N/A	N/A
Construction			
Construction	22,500	N/A	N/A
Contingency	4,500	N/A	N/A
Total, Construction	27,000	N/A	N/A
Total, TEC^a	30,000	N/A	N/A
<i>Contingency, TEC</i>	<i>5,000</i>	<i>N/A</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
Conceptual Planning	250	N/A	N/A
Conceptual Design	250	N/A	N/A
Contingency	500	N/A	N/A
Total, OPC	1,000	N/A	N/A
<i>Contingency, OPC</i>	<i>500</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^a	31,000	N/A	N/A
Total, Contingency (TEC+OPC)	5,500	N/A	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2020	FY 2021	Outyears	Total
FY 2021	TEC	—	2,000	28,000	30,000 ^a
	OPC ^b	250	250	500	1,000
	TPC	250	2,250	28,500	31,000 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	25 years
Expected Future Start of D&D of this capital asset	4Q FY 2051

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs ^a	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	TBD	N/A	TBD
Utilities	N/A	TBD	N/A	TBD
Maintenance and Repair	N/A	TBD	N/A	TBD
Total, Operations and Maintenance	N/A	TBD	N/A	TBD

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Ames Laboratory.....	None
Area of D&D in this project at Ames Laboratory.....	None
Area at Ames Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^b
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

8. Acquisition Approach

The Ames Management and Operating (M&O) contractor, Iowa State University, will perform the acquisition for this project, overseen by the Ames Site Office. It will evaluate various acquisition approaches and consider project delivery methods prior to achieving CD-1. The M&O contractor will be responsible for awarding and administering all subcontracts related to this project. The M&O contractor’s annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated.

^a Life-Cycle costs will be performed as part of CD-1.

^b With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**20-SC-71, Critical Utilities Rehabilitation Project
Brookhaven National Laboratory (BNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Critical Utilities Rehabilitation Project (CURP) is \$15,000,000. The current preliminary Total Estimated Cost (TEC) range for this project is \$70,000,000 to \$92,000,000. The preliminary Total Project Cost (TPC) range for this project is \$70,800,000 to \$92,800,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$92,800,000.

This project will upgrade failing utility infrastructure that is still in use from BNL’s origins as World War II Army Camp Upton. Utility systems including steam, water, sanitary sewer, chilled water, and electrical systems will be revitalized and upgraded to meet the needs of supporting SC facilities and the Nuclear Physics (NP), Basic Energy Sciences (BES), High Energy Physics (HEP), Biological and Environmental Research (BER), and Advanced Scientific Computing Research (ASCR) programs.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on July 20, 2018. The project performed an analysis of Alternatives, which was approved by the SLI program, and approval of CD-1 is expected in the second quarter of FY 2020. The selected alternative is to repair or replace critical systems and components of the utility systems. FY 2021 funds will support long-lead procurement and early construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) will be assigned to this project.

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 2020	7/20/18	4Q FY 2019	4Q FY 2019 ^a	4Q FY 2020 ^a	4Q FY 2021	4Q FY 2021 ^a	N/A	4Q FY 2026 ^a
FY 2021	7/20/18	4Q FY 2019	2Q FY 2020 ^a	2Q FY 2021 ^a	3Q FY 2021	4Q FY 2021 ^a	N/A	4Q FY 2024 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2020	4Q FY 2020 ^a	N/A
FY 2021	4Q FY 2020 ^a	2Q FY 2020

CD-3A – Approve Long-Lead Procurements, Original Scope

^a This project is pre-CD-2; therefore, funding and schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2020	8,500	76,500	85,000	800	N/A	800	85,800
FY 2021	7,100	84,900	92,000 ^b	800	N/A	800	92,800 ^b

2. Project Scope and Justification

Scope

CURP's scope is to revitalize and upgrade highest risk major utility systems across the BNL campus by replacing piping in areas prone to water main breaks and provide other water system improvements to improve system operations and reliability. The project will also replace select sections of the sanitary utility systems with failing pumps, controllers, and/or manholes, and provide several required modifications to the central chilled water system in order to support growth of process loads and assure reliability. CURP will replace deteriorated and leaking steam systems along Cornell Avenue to assure safe, reliable, and efficient steam service to mission critical facilities on the north side of the campus, and older feeder cables and inadequate breakers along Cornell Avenue, which will increase capacity, reliability, and personnel safety.

Justification

BNL is a multi-program DOE national laboratory with recognized impact on national science needs. BNL provides scientific leadership in NP, photon sciences, energy science for BES, and data-driven discovery for ASCR, with leading programs in selected areas of HEP, BER, accelerator science and technology, and national security and non-proliferation. BNL utilizes world-class facilities and core expertise to: advance energy and environment-related basic research and apply them to 21st Century problems of critical importance to the Nation; and advance fundamental research in nuclear and particle physics to gain a deeper understanding of matter, energy, space, and time.

Although there has been substantial investment in recent years to modernize and construct new research facilities at BNL, much of BNL's utility infrastructure serving these facilities is over 50 years old and some is over 70 years old, dating to BNL's origin as a U. S. Army base during World Wars I and II. Efficient, maintainable, and reliable utilities are critical to the success and mission capability of BNL's research facilities. Currently, a significant portion of BNL's utility infrastructure is beyond useful life and suffering from failures, decreased reliability, lack of redundancy, and limitations in capacity. As such, there is an urgent need to revitalize and selectively upgrade BNL's existing major utility systems to assure reliable service, meet capacity requirements, and enable readiness of facilities critical to the research mission.

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*.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> ▪ Rehabilitate and selectively upgrade BNL’s existing major utility systems including steam, water, sanitary sewer, chilled water and electrical systems. 	<ul style="list-style-type: none"> ▪ Renovate the Central Chilled Water Facility ▪ Replace 3,000 linear feet (LF) of steam/condensate piping ▪ Renovate Building 610 (B610) ▪ Renovate Wellhouse #12 ▪ Replace 300,000 gallon water tank ▪ Install new 13.8 kilovolt feeder ▪ Renovate substation 603 ▪ Re-line 200 LF of sewer lines 	<ul style="list-style-type: none"> ▪ Renovate chilled water system ▪ Upgrade B610 Building Envelope ▪ Replace up to 45 miles of water service lines ▪ Renovate 1 million gallon water tank ▪ Renovate electrical system ▪ Renovate sanitary sewer system.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	7,100	7,100	7,100
Total, Design	7,100	7,100	7,100
Construction			
FY 2020	12,900	12,900	2,900
FY 2021	15,000	15,000	15,000
Outyears	57,000	57,000	67,000
Total, Construction	84,900	84,900	84,900
Total Estimated Cost (TEC)			
FY 2020	20,000	20,000	10,000
FY 2021	15,000	15,000	15,000
Outyears	57,000	57,000	67,000
Total, TEC^a	92,000	92,000	92,000
Other Project Cost (OPC)^b			
FY 2019	800	800	800
Total, OPC	800	800	800

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	800	800	800
FY 2020	20,000	20,000	10,000
FY 2021	15,000	15,000	15,000
Outyears	57,000	57,000	67,000
Total, TPC^a	92,800	92,800	92,800

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	5,680	6,800	N/A
Contingency	1,420	1,700	N/A
Total, Design	7,100	8,500	N/A
Construction			
Construction	70,320	61,200	N/A
Contingency	14,580	15,300	N/A
Total, Construction	84,900	76,500	N/A
Total, TEC^a	92,000	85,000	N/A
<i>Contingency, TEC</i>	<i>16,000</i>	<i>17,000</i>	<i>N/A</i>
Other Project Cost (OPC)			
OPC except D&D			
Other OPC Costs	800	800	N/A
Contingency	—	—	N/A
Total, OPC^b	800	800	N/A
<i>Contingency, OPC</i>	<i>—</i>	<i>—</i>	<i>N/A</i>
Total Project Cost^a	92,800	85,800	N/A
Total, Contingency (TEC+OPC)	16,000	17,000	N/A

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	—	12,000	—	73,000	85,000 ^a
	OPC ^b	800	—	—	—	800
	TPC	800	—	—	73,000	85,800 ^a
FY 2021	TEC	—	20,000	15,000	57,000	92,000 ^a
	OPC ^b	800	—	—	—	800
	TPC	800	20,000	15,000	57,000	92,800 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	N/A
Expected Useful Life	Varies by System
Expected Future Start of D&D of this capital asset	N/A

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	N/A	N/A	N/A
Utilities	N/A	N/A	N/A	N/A
Maintenance and Repair	N/A	N/A	N/A	N/A
Total, Operations and Maintenance	N/A	N/A	N/A	N/A

7. D&D Information

This project replaces critical infrastructure components and minimal, if any, support buildings will be constructed. The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Brookhaven National Laboratory	None
Area of D&D in this project at Brookhaven National Laboratory	None
Area at Brookhaven National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^c
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

^c With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

8. Acquisition Approach

The BNL Management and Operating (M&O) Contractor, Brookhaven Science Associates, will perform the acquisition for this project, overseen by the Brookhaven Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project and will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-1. Potential acquisition and project delivery methods include, but are not limited to, firm-fixed-price contracts for design-bid-build and construction manager/general contractor methods. The M&O contractor will also evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning and other project scope elements. The M&O contractor's annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

**20-SC-72, Seismic and Safety Modernization
Lawrence Berkeley National Laboratory (LBNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Seismic and Safety Modernization (SSM) project is \$10,000,000. The preliminary Total Estimated Cost (TEC) range is \$76,320,000 to 95,400,000 and the preliminary the Total Project Cost (TPC) range is \$78,520,000 to \$97,600,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$97,600,000.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on September 4, 2019. FY 2021 funds will initiate long-lead procurement and early construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) has been assigned to this project.

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 2020	9/06/18	4Q FY 2019	4Q FY 2019 ^a	4Q FY 2021 ^a	4Q FY 2022	4Q FY 2022 ^a	N/A	4Q FY 2027 ^a
FY 2021	9/06/18	6/17/19	9/04/19	3Q FY 2021 ^a	1Q FY 2022	2Q FY 2022 ^a	N/A	2Q FY 2027 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2020	4Q FY 2021	N/A	N/A
FY 2021	3Q FY 2021	3Q FY 2021	N/A

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

CD-3B – Approve Start of Remaining Construction Activities

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2020	10,000	85,400	95,400 ^b	2,200	N/A	2,200	97,600 ^b
FY 2021	10,000	85,400	95,400 ^b	2,200	N/A	2,200	97,600 ^b

2. Project Scope and Justification

Scope

The SSM project will construct a new facility on the existing cafeteria site to house the cafeteria, health services and operational support services (human resources, conferencing and other potential groups) to meet the requirements of Risk Category IV of the California Building Code (CBC). In addition, the second floor of the B48 (Fire House) will be seismically upgraded to meet Risk Category IV of the CBC.

Justification

The Lawrence Berkeley National Laboratory executes 22 of the Office of Science's (SC'S) 24 core capabilities and the mission of multiple SC program offices, with specifically strong presences of the Advanced Scientific Computing Research, Biological and Environment Research, Basic Energy Sciences, and High Energy Physics programs. LBNL is located on a 202 acre site in the hills above the University of California, Berkeley campus employs approximately 3,400 full time employees; and is home to five SC national user facilities: the Advanced Light Source, the Energy Sciences Network, the Joint Genome Institute, the Molecular Foundry, and the National Energy Research Scientific Computing Center. In FY 2016, over 11,000 researchers used these facilities, representing roughly one third of the total for all SC user facilities. In pursuing the SC mission, LBNL leverages collaborative science to bring together teams of individuals with different fields of expertise to work together on common solutions to the SC mission. However, these research activities must be executed with a unique caution since LBNL is located less than one mile from the Hayward Fault and less than 25 miles from the San Andreas Fault, which would both pose a life safety risk to employees, visitors, and guests during a significant seismic event.

The U.S. Geological Survey's newest earthquake forecast, the third Uniform California Earthquake Rupture Forecast (UCERF3), states a 98 percent probability of a 6.0 magnitude or higher earthquake in the San Francisco Bay Area before 2043. Recent engineering evaluations from a San Francisco Bay Area structural engineering firm have identified significant and extensive seismic safety hazards in critical LBNL support buildings, including the Cafeteria, Health Services, and Fire House. Structural deficiencies identified in these buildings will likely cause significant structural damage with life safety hazards during a magnitude 6.0+ earthquake on the Hayward Fault or a magnitude 8.3 earthquake on the San Andreas Fault and will impede LBNL's ability to resume operations.

The SSM project will address seismic safety issues and emergency response capabilities, specifically related to facilities with large congregation areas as well as improve facilities and transportation capabilities that are necessary for emergency response personnel and maintaining continuity of operations. The facilities that are the primary focus of this project are the Cafeteria, Health Services, and Fire House sleepquarters. Demolition of the cafeteria is anticipated to allow for construction of a new facility. Additional supporting functions such as utilities or site modifications may be included in the project, if they are deemed necessary.

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*.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project is pre-CD-2; therefore, funding estimates are preliminary.

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
New Facility to include a Cafeteria, Health Services & Operational Support Services	<ul style="list-style-type: none"> ▪ 35,000 gross square feet (gsf) ▪ Meet requirements of Risk Category III of the CBC 	<ul style="list-style-type: none"> ▪ 60,000 gsf ▪ Meet requirements of Risk Category III of the CBC
Seismic Upgrade of B48 (Fire House)	<ul style="list-style-type: none"> ▪ Meet requirements of Risk Category IV of CBC 	N/A

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	10,000	10,000	8,000
FY 2021	—	—	2,000
Total, Design	10,000	10,000	10,000
Construction			
FY 2021	10,000	10,000	5,000
Outyears	75,400	75,400	80,400
Total, Construction	85,400	85,400	85,400
Total Estimated Cost (TEC)			
FY 2020	10,000	10,000	8,000
FY 2021	10,000	10,000	7,000
Outyears	75,400	75,400	80,400
Total, TEC^a	95,400	95,400	95,400
Other Project Cost (OPC)			
FY 2019	1,500	1,500	1,490
FY 2020	100	100	100
Outyears	600	600	610
Total, OPC^b	2,200	2,200	2,200

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	1,500	1,500	1,490
FY 2020	10,100	10,100	8,100
FY 2021	10,000	10,000	7,000
Outyears	76,000	76,000	81,010
Total, TPC^a	97,600	97,600	97,600

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	8,300	8,500	N/A
Contingency	1,700	1,500	N/A
Total, Design	10,000	10,000	N/A
Construction			
Construction	70,400	68,400	N/A
Contingency	15,000	17,000	N/A
Total, Construction	85,400	85,400	N/A
Total, TEC^a	95,400	95,400	N/A
<i>Contingency, TEC</i>	<i>16,700</i>	<i>18,500</i>	—
Other Project Cost (OPC)			
OPC except D&D			
OPC except D&D	2,000	2,000	N/A
Contingency	200	200	N/A
Total, OPC^b	2,200	2,200	N/A
<i>Contingency, OPC</i>	<i>200</i>	<i>200</i>	<i>N/A</i>
Total Project Cost^a	97,600	97,600	N/A
Total, Contingency (TEC+OPC)	16,900	18,700	N/A

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	—	5,000	—	90,400	95,400 ^a
	OPC ^b	1,500	—	—	700	2,200
	TPC	1,500	5,000	—	91,100	97,600 ^a
FY 2021	TEC	—	10,000	10,000	75,400	95,400 ^a
	OPC ^b	1,500	100	—	600	2,200
	TPC	1,500	10,100	10,000	76,000	97,600 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2027
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2077

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	TBD	N/A	TBD	N/A
Utilities	TBD	53	TBD	2,658
Maintenance and Repair	TBD	318	TBD	15,882
Total, Operations and Maintenance	TBD	371	TBD	18,540

7. D&D Information

The new area being constructed in this project is replacing existing facilities.

	Square Feet
New area being constructed by this project at Lawrence Berkeley National Laboratory.....	35,000 - 60,000
Area of D&D in this project at Lawrence Berkeley National Laboratory.....	None
Area at Lawrence Berkeley National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^c
Area of D&D in this project at other sites.....	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”.....	None
Total area eliminated.....	15,000 - 60,000

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

^c With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

8. Acquisition Approach

The LBNL Management and Operating (M&O) Contractor, University of California, will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor evaluated various acquisition approaches and project delivery methods prior to achieving CD-1, and selected a Construction Manager/General Contractor approach as the best method to deliver the project. The M&O contractor is also responsible for awarding and administering all subcontracts related to this project. Its annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated.

**20-SC-73, CEBAF Renovation and Expansion
Thomas Jefferson National Accelerator Facility (TJNAF)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the CEBAF Renovation and Expansion project is \$2,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$47,000,000 to \$96,000,000. The preliminary Total Project Cost (TPC) range for this project is \$48,900,000 to \$99,300,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$89,300,000.

The CEBAF center at TJNAF is currently overcrowded and has inadequate utility systems that are experiencing frequent failures. This project will renovate 123,000 to 250,000 gross square feet (gsf) of existing space in the CEBAF center and the Applied Research Center (ARC), upgrade high risk utility systems, and provide 82,000 to 150,000 gsf of additional space for visitors, users, research, education, and support.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on July 20, 2018. FY 2021 funds will support the continuation of Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) has been assigned to this project.

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 2020	7/20/18	4Q FY 2019	4Q FY 2019	4Q FY 2020 ^a	3Q FY 2021	4Q FY 2021 ^a	N/A	4Q FY 2026 ^a
FY 2021	7/20/18	4Q FY 2019	2Q FY 2020	4Q FY 2020 ^a	3Q FY 2021	4Q FY 2021 ^a	N/A	4Q FY 2026 ^a

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 complete

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	CD-3B
FY 2020	4Q FY 2020 ^a	N/A	N/A
FY 2021	4Q FY 2020 ^a	4Q FY 2020 ^a	4Q FY 2021 ^a

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

CD-3B – Approve Start of Remaining Construction Activities

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2020	4,200	61,800	66,000 ^b	1,900	N/A	1,900	67,900 ^b
FY 2021	5,000	82,000	87,000 ^b	2,300	N/A	2,300	89,300 ^b

2. Project Scope and Justification

Scope

The scope of the CEBAF Renovation and Expansion project will include renovating 123,000 to 250,000 gsf of existing space and providing 82,000 to 150,000 gsf of additional office and laboratory space (including acquisition of the ARC) for 120 to 200 research, education, and support staff. The renovation will include reconfiguration to provide more functional, flexible, and efficient spaces that meet current code standards. The CEBAF Renovation and Expansion project will replace the mechanical systems in the existing CEBAF Center, which have exceeded their service life and experienced multiple failures. The renovated building will be energy sustainable and will meet high performance building standards, including energy conservation, green building principles, and sustainable design, and the project will design the building to meet Federal legislative objectives. Upon completion, SC will relocate administrative and support staff from the Service Support Center (SSC) (leased space) into the ARC, and TJNAF will dedicate the CEBAF Center to scientific staff to more efficiently address functional workspace needs for TJNAF staff and users.

Justification

With a population of nearly 1,600 users, TJNAF supports one of the largest nuclear physics user communities in the world. The expanded scientific scope associated with the 12 GeV upgrade (e.g., double the energy with simultaneous delivery to four experimental halls) is creating more and larger collaborations, requiring more technical workshops, and resulting in more visitors to the Lab. The Laboratory expects staff and user population to increase 2 percent per year for the next 10 years and will soon exceed available space, which is already near capacity. Further, TJNAF is actively pursuing a number of large inter-entity transfer projects such as the cryomodules and cryogenics plants for LCLS-I, LCLS-II-HE, FRIB, and UUP that it projects will require additional staffing. TJNAF will continue to play a key role in the design and development of emerging SC initiative(s).

Currently TJNAF is lacking technically-equipped and functional space to accommodate advanced scientific research and major missions on the immediate horizon. The existing CEBAF Center is well beyond full capacity. The current occupant density of this building is 110 gsf per occupant which is significantly below the DOE standard of 180 gsf per occupant. In addition, utility systems at the CEBAF center are inadequate, failing, and inefficient for the existing usage, let alone the potential anticipated usage in the near future.

TJNAF also continues to advance a strategic campus plan designed to deliver more attractive, mission-focused, and functional workspaces by consolidating the Lab workforce scattered over several leased buildings in a single center that provides more effective and efficient operations. This includes appropriately consolidating workers currently housed in the ARC and SSC leased spaces. This would allow for costly leases to be discontinued and reduce the cost to sustain existing buildings and infrastructure and more efficiently address functional workspace needs for TJNAF staff and users.

TJNAF must be prepared to accommodate planned staff and user growth which means additional office space must be programmed soon. The Laboratory is pursuing Major Items of Equipment, several large inter-entity transfer projects for other National Labs, and a pivotal technical role in a proposed Electron Ion Collider.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project is pre-CD-2; therefore, funding estimates are preliminary.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
CEBAF Center Renovation	66,000 gsf	128,000 gsf
CEBAF Center Expansion	22,000 gsf	82,000 gsf
ARC Renovation	57,000 gsf	121,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	2,000	2,000	2,000
FY 2021	2,000	2,000	2,000
Outyears	1,000	1,000	1,000
Total, Design	5,000	5,000	5,000
Construction			
Outyears	82,000	82,000	82,000
Total, Construction	82,000	82,000	82,000
Total Estimated Cost (TEC)			
FY 2020	2,000	2,000	2,000
FY 2021	2,000	2,000	2,000
Outyears	83,000	83,000	83,000
Total, TEC^a	87,000	87,000	87,000
Other Project Cost (OPC)			
FY 2019	1,000	1,000	1,000
FY 2020	700	700	700
Outyears	600	600	600
Total, OPC^b	2,300	2,300	2,300

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	1,000	1,000	1,000
FY 2020	2,700	2,700	2,700
FY 2021	2,000	2,000	2,000
Outyears	83,600	83,600	83,600
Total, TPC^a	89,300	89,300	89,300

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	4,200	3,400	N/A
Contingency	800	800	N/A
Total, Design	5,000	4,200	N/A
Construction			
Construction	68,300	49,800	N/A
Contingency	13,700	12,000	N/A
Total, Construction	82,000	61,800	N/A
Total, TEC^a	87,000	66,000	N/A
<i>Contingency, TEC</i>	<i>14,500</i>	<i>12,800</i>	<i>N/A</i>
Other Project Cost (OPC)			
OPC except D&D			
OPC except D&D	2,300	1,900	N/A
Contingency	—	N/A	N/A
Total, OPC	2,300	1,900	N/A
<i>Contingency, OPC</i>	<i>—</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^a	89,300	67,900	N/A
Total, Contingency (TEC+OPC)	14,500	12,800	N/A

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	—	—	2,000	—	64,000	66,000 ^a
	OPC ^b	20	1,465	—	—	415	1,900
	TPC	20	1,465	2,000	—	64,415	67,900 ^a
FY 2021	TEC	—	—	2,000	2,000	83,000	87,000 ^a
	OPC ^b	—	1,000	700	—	600	2,300
	TPC	—	1,000	2,700	2,000	83,600	89,300 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2076

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	288	288	14,400	14,400
Utilities	432	432	21,600	21,600
Maintenance and Repair	1,008	1,008	50,400	50,400
Total, Operations and Maintenance	1,728	1,728	86,400	86,400

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Thomas Jefferson National Accelerator Facility	82,000 - 150,000
Area of D&D in this project at Thomas Jefferson National Accelerator Facility	None
Area at Thomas Jefferson National Accelerator Facility to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^c
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

^c With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

8. Acquisition Approach

The TJNAF Management and Operating (M&O) contractor, Jefferson Science Associates, will perform the acquisition for this project, overseen by the Thomas Jefferson Site Office. The M&O contractor will consider various acquisition approaches and project delivery methods prior to achieving CD-1 and will be responsible for awarding and administering all subcontracts related to this project. Its annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated.

**20-SC-74, Craft Resources Support Facility
Oak Ridge National Laboratory (ORNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Craft Resources Support Facility (CRSF) is \$25,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$34,000,000 to \$48,000,000 and the preliminary Total Project Cost (TPC) range for this project is \$35,000,000 to \$49,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$41,000,000.

This project will provide a new facility for ORNL craft services (vehicle maintenance, etc.) to facilitate more efficient and consolidated operations. Additional meeting space and shower facilities will be provided for many ORNL craft groups as efficiencies are achieved. It will also demolish small buildings currently within the footprint of the proposed building.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on July 20, 2018. The project recently held an independent project review for CD-1, Alternatives Selection and Cost Range, which occurred in August 2019. FY 2021 funds will support construction and associated activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level I: TPC greater than \$5,000,000 and equal to or less than \$50,000,000) was assigned to this project.

In an August 2, 2018 memorandum, Dr. Stephen Binkley set an SC policy “... to initiate a process that devolves the responsibility for planning, executing, and successfully delivering selected SC projects to a lower level in DOE’s line management. The intent is to exempt capital asset projects with a Total Project Cost (TPC) less than \$50 million from the requirements of DOE Order 413.3B, and delegate responsibility for their successful delivery from SC Associate Director’s to the cognizant SC Laboratory Director...” In keeping with the intent of this policy, ORNL is seeking to have the responsibility for management of the CRSF project delegated to the laboratory, and will have submitted a formal delegation request, that may also be approved at CD-1. If it is delegated, a notable outcome will be inserted into the annual Performance Evaluation and Measurement Plan for the ORNL M&O contractor that will allow DOE to evaluate the M&O’s performance in meeting this project’s established milestones.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	KD-2 ^a	Final Design Complete	KD-3 ^a	D&D Complete	KD-4 ^a
FY 2020	7/20/18	4Q FY 2019	4Q FY 2019 ^b	3Q FY 2020 ^b	3Q FY 2019	3Q FY 2020 ^b	N/A	4Q FY 2023 ^b
FY 2021	7/20/18	4Q FY 2019	2Q FY 2020 ^b	2Q FY 2021 ^b	4Q FY 2021	1Q FY 2022 ^b	N/A	4Q FY 2025 ^b

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

KD-2 – “Key Decision” to indicate responsibility for project management has been delegated to the Laboratory. Approve Performance Baseline

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

KD-3 – Approve Start of Construction

^a If Delegation is approved, Critical Decisions (CD) will transition to “Key Decisions (KD)” for the duration of the project.

^b This project is pre-CD-2; therefore, schedule estimates are preliminary.

KD-4 – Approve Start of Operations or Project Closeout

KD-4B / KD-4 – Completion of D&D work / Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-2/3 ^a	CD-3A ^a	CD-3B ^a	KD-4A	KD-4B
FY 2020	3Q FY 2020 ^b	3Q FY 2020 ^b	N/A	N/A	N/A	N/A
FY 2021	2Q FY 2021 ^b	N/A	N/A	N/A	4Q FY 2024 ^b	4Q FY 2025 ^b

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

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

CD-3B – Approve Start of Remaining Construction Activities

KD-4A – Completion of CRSF construction

KD-4B/KD-4 – Completion of potential demolition of vacated buildings / Project Closeout

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^c , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2020	4,000	36,000	40,000 ^b	500	N/A	500	40,500 ^b
FY 2021	3,600	36,400	40,000 ^b	1,000	N/A	1,000	41,000 ^b

2. Project Scope and Justification

Scope

The CRSF project’s scope includes constructing an estimated 60,900 gross square feet (gsf) to 79,300 gsf building that will provide modern space with an appropriate design, configuration, and environmental conditions to maintain ORNL infrastructure and support activities in support of multiple SC research programs. Activities to be relocated from obsolete buildings into new facility include skilled craft services like vehicle garage and maintenance, grounds maintenance, painting and signage, hoisting and rigging, etc., as well as storage for high-value equipment and materials. The project also includes demolition of several small buildings (approximately 3,600 gsf) currently within the footprint of the proposed building. Additive scope would include demolition of up to 50,000 gsf of vacated facilities once construction of CRSF facilities is complete and would be based on the accomplishment of the base scope.

Justification

SC utilizes over 20 core capabilities supported by ORNL and core mission facilities at ORNL, such as the Spallation Neutron Source (SNS), the High Flux Isotope Reactor (HFIR), and the Oak Ridge Leadership Computing Facility (OLCF). These core capabilities and facilities support the mission of Basic Energy Sciences, Fusion Energy Sciences, Nuclear Physics, Biological & Environmental Research, and Advanced Scientific Computing Research.

The complex infrastructure required to support the SC mission and associated facilities places a substantial demand on craft resource support functions, which is comprised of 28 different trades ranging from automotive mechanics to instrument technicians. Craft resources within ORNL’s Facilities and Operations Directorate maintains and/or supports the Laboratory’s 5.7 million square feet of space, maintains a fleet of over 400 vehicles, and supplies utilities to this footprint including nearly 50 miles of water distribution piping, 670 million pounds of high-pressure steam distributed over 10 miles of steam lines, three major electrical substations, 60 miles of overhead transmission lines, and 14,000 tons of chilled water production.

^a If Delegation is approved, Critical Decisions (CD) will transition to “Key Decisions (KD)” for the duration of the project.

^b This project is pre-CD-2; therefore, funding and schedule estimates are preliminary.

^c Other Project Costs (OPC) are funded through laboratory overhead.

Continued research at ORNL that supports over 3,200 users utilizing the many user facilities, as well as experimental and developmental research facilities, are dependent on support services provided by craft resources. Due to the distinctive nature and complexity of many of ORNL infrastructure systems, in house craft services are often required to respond to unique circumstances. Similarly, operational inefficiencies in these areas result in a ripple effect that increases risk to SC research productivity and the ORNL science mission. Inefficient operation of craft resource support services directly impacts many high-priority science programs at ORNL.

ORNL mission support personnel provide multiple services supporting the ORNL science mission such as roads, grounds maintenance, vehicle maintenance and repair garage, electricians, inspectors, and others. These support services are currently housed in multiple inadequate facilities spread across the 7000 area, which are outdated and poorly configured, resulting in inefficient operations, congested vehicle and pedestrian traffic patterns, and increased safety risks. These conditions are creating inefficient, unreliable operations that are directly impacting many high-priority SC programs at ORNL. Current facilities also lack conditioned space and covered storage that reduces life for high value equipment and materials as well provide poor working conditions for staff.

This project provides modern space with appropriate design, configuration, and environmental conditions to support activities conducted at user, experimental, and developmental research facilities for multiple SC research programs including SNS, HFIR, and OLCF.

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* through CD-1, after which, project management is expected to be delegated.

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Craft services support buildings	60,900 gsf	79,300 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	3,600	3,600	1,600
FY 2021	—	—	2,000
Total, Design	3,600	3,600	3,600
Construction			
FY 2020	11,400	11,400	—
FY 2021	25,000	25,000	—
Outyears	—	—	36,400
Total, Construction	36,400	36,400	36,400

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
FY 2020	15,000	15,000	1,600
FY 2021	25,000	25,000	2,000
Outyears	—	—	36,400
Total, TEC^a	40,000	40,000	40,000
Other Project Cost (OPC)			
FY 2019	800	800	800
Outyears	200	200	200
Total, OPC^b	1,000	1,000	1,000
Total Project Cost (TPC)			
FY 2019	800	800	800
FY 2020	15,000	15,000	1,600
FY 2021	25,000	25,000	2,000
Outyears	200	200	36,600
Total, TPC^a	41,000	41,000	41,000

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	2,790	3,500	N/A
Contingency	780	500	N/A
Total, Design	3,570	4,000	N/A
Construction			
Construction	28,510	30,000	N/A
Contingency	7,920	6,000	N/A
Total, Construction	36,430	36,000	N/A
Total, TEC^a	40,000	40,000	N/A
<i>Contingency, TEC</i>	<i>8,700</i>	<i>6,500</i>	<i>N/A</i>

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Design	800	420	N/A
Contingency	200	80	N/A
Total, OPC^a	1,000	500	N/A
<i>Contingency, OPC</i>	<i>200</i>	<i>80</i>	<i>N/A</i>
Total Project Cost^b	41,000	40,500	N/A
Total, Contingency (TEC+OPC)	8,900	6,580	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	—	20,000	20,000	—	40,000 ^b
	OPC ^a	400	—	100	—	500
	TPC	400	20,000	20,100	—	40,500 ^b
FY 2021	TEC	—	15,000	25,000	—	40,000 ^b
	OPC ^a	800	—	—	200	1,000
	TPC	800	15,000	25,000	200	41,000 ^b

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2024
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2074

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	101	135	4,249	6,750
Utilities	146	90	6,141	4,500
Maintenance and Repair	194	145	8,161	7,250
Total, Operations and Maintenance	441	370	18,551	18,500

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval; therefore, funding estimates are preliminary.

7. D&D Information

The new area being constructed in this project is replacing existing facilities.

	Square Feet
New area being constructed by this project at Oak Ridge National Laboratory.....	60,900 - 79,300
Area of D&D in this project at Oak Ridge National Laboratory.....	3,568
Area at Oak Ridge National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated (in base scope).....	3,568

8. Acquisition Approach

The ORNL Management and Operating (M&O) Contractor, UT-Battelle, will perform the acquisition for this project overseen by the ORNL Site Office. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. The M&O contractor will evaluate various acquisition and project delivery methods prior to achieving CD-1 and will evaluate potential benefits of using a single contract or multiple contracts to procure materials, equipment, construction, commissioning and other project scope elements. The M&O’s annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**20-SC-75, Large Scale Collaboration Center
SLAC National Accelerator Laboratory (SLAC)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Large Scale Collaboration Center (LSCC) is \$8,000,000. The current preliminary Total Estimated Cost (TEC) range for this project is \$56,000,000 to \$90,400,000. The current preliminary Total Project Cost (TPC) range for this project is \$59,400,000 to \$92,400,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$66,000,000.

This project will construct a new facility allowing for collocation of cross-functional teams in a common building, providing synergies between all major SC-sponsored programs.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on November 18, 2019. The project performed an analysis of Alternatives, which was approved by the SLI program, and determined the preferred alternative is to construct a new building. FY 2021 funds will support long-lead procurements and early construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) has been assigned to this project.

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 2020	7/20/18	4Q FY 2019	4Q FY 2019 ^a	4Q FY 2020 ^a	4Q FY 2020	4Q FY 2020 ^a	N/A	4Q FY 2026 ^a
FY 2021	7/20/18	4Q FY 2019	11/18/19	1Q FY 2022 ^a	1Q FY 2023 ^a	1Q FY 2023 ^a	3Q FY 2023	4Q FY 2027 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2020	TBD	N/A	N/A
FY 2021	TBD	1Q FY 2020 ^a	1Q FY 2023 ^a

CD-3A – Approve Long-Lead Procurements and Start of Early Construction

CD-3B – Approve Remaining Construction Activities

^a This project is pre-CD-2; therefore, schedule and funding estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC^a, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2020	6,000	54,000 ^b	60,000 ^b	1,000	N/A	1,000	61,000 ^b
FY 2021	9,000	55,000 ^b	64,000 ^b	2,000	N/A	2,000	66,000 ^b

2. Project Scope and Justification

Scope

The Large Scale Collaboration Center (LSCC) project will construct a multi-office building of approximately 34,000 to 42,000 gross square feet (gsf) to consolidate and provide space for 100-150 occupants in a common building. The LSCC will provide synergies among all major SC-sponsored programs at SLAC and provide a centralized office and collaboration space for cross-functional teams with the necessary performance capabilities to grow the science research programs.

Justification

Advances in scientific exploration require the coordinated development of an extensive range of sophisticated imaging tools and extremely large amounts of data sets and images for current and future user facilities and research programs, including the Linac Coherent Light Source (LCLS), the LCLS-II and LCLS-II-HE, the Stanford Synchrotron Radiation Laboratory (SSRL), Cryo-Electron Microscopy (EM), ATLAS at the Large Hadron Collider (LHC), the Large Synoptic Survey Telescope (LSST), the Deep Underground Neutrino Experiment (DUNE), and the Facility for Advanced Accelerator Experimental Tests (FACET)-II.

Existing buildings provide sufficient laboratory and experimental space. Current office spaces near experimental areas, however, are fully occupied or oversubscribed, and projected staff and user increases exceed availability of adequate space. Office spaces in current buildings are not properly configured and do not address the pressing need to accommodate teams that are developing critical algorithms and data analysis techniques alongside staff scientists or visiting researchers and users.

With growing numbers of scientific staff and users dealing with increased rates of data generation on the order of terabytes per second streaming from detectors, it is essential to reduce data volumes while preserving the science content of the data. This can be accomplished by collaborating with expertise in data science and massive-scale data analytics. The real-time computing for data reduction and, most importantly, for feedback defines the scale of the computing infrastructure required onsite and offsite. This real-time feedback, done during experiment operation and between shifts, is instrumental for the user to optimize the experiment and receive datasets as complete as possible before leaving the facility. Cross-functional teams that understand accelerator and instrument operations also need to collaborate to address the common and expanding need for substantial computation support.

Furthermore, the High Energy Density program is also working closely with SLAC's LCLS directorate and the U.S. scientific community to advance the Matter in Extreme Conditions (MEC) project, which will result in much improved optical and x-ray laser capabilities that will enable novel experiments to push the scientific frontier. Scientists at the MEC project will perform these activities in collaboration with LCLS and academic partners and users ahead of full-scale experiments at LCLS.

SLAC currently lacks office spaces for scientists and staff to jointly explore challenges and develop solutions using large-scale data sets. Adjacent office spaces that enable researchers to benefit from collaboration with subject matter experts in computational science, AI/ML, exascale computing, data management, data acquisition, simulation, imaging, visualization, and modeling are also not currently available.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project is pre-CD-2; therefore, funding estimates are preliminary.

To address these capability gaps, SLAC proposes to construct a new LSCC. Without it, SLAC will be unable to collocate cross-functional teams that understand accelerator and instrument operations, provide synergies between all major SC-sponsored programs at SLAC, engage a broad spectrum of researchers in a common building to explore materials science, chemical science, cosmology, computational support, AI/ML, exascale applications, and quantum information science (QIS); engage in private partnerships; and provide a centralized office and collaboration space with the necessary performance capabilities to grow the photon science research program.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Multi-Story Office Building	34,000 gsf	45,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	9,000	9,000	7,000
FY 2021	—	—	2,000
Total, Design	9,000	9,000	9,000
Construction			
FY 2020	2,000	2,000	—
FY 2021	8,000	8,000	1,000
Outyears	45,000	45,000	54,000
Total, Construction	55,000	55,000	55,000
Total Estimated Cost (TEC)			
FY 2020	11,000	11,000	7,000
FY 2021	8,000	8,000	3,000
Outyears	45,000	45,000	54,000
Total, TEC^a	64,000	64,000	64,000

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	500	500	500
FY 2020	200	200	200
FY 2021	1,300	1,300	1,300
Total, OPC^a	2,000	2,000	2,000
Total Project Cost (TPC)			
FY 2019	500	500	500
FY 2020	11,200	11,200	7,200
FY 2021	9,300	9,300	4,300
Outyears	45,000	45,000	54,000
Total, TPC^b	66,000	66,000	66,000

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	7,200	4,800	N/A
Contingency	1,800	1,200	N/A
Total, Design	9,000	6,000	N/A
Construction			
Construction	45,000	43,000	N/A
Contingency	10,000	11,000	N/A
Total, Construction	55,000	54,000	N/A
Total, TEC^b	64,000	60,000	N/A
<i>Contingency, TEC</i>	<i>11,800</i>	<i>12,200</i>	<i>N/A</i>

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval; therefore, funding estimates are preliminary.

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Other Project Cost (OPC)			
OPC except D&D			
OPC Costs	1,600	1,000	N/A
Contingency	400	—	N/A
Total, OPC^a	2,000	1,000	N/A
<i>Contingency, OPC</i>	<i>400</i>	<i>—</i>	<i>N/A</i>
Total Project Cost^b	66,000	61,000	N/A
Total, Contingency (TEC+OPC)	12,200	12,200	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	—	3,000	—	57,000	60,000 ^b
	OPC ^a	700	—	—	300	1,000
	TPC	700	3,000	—	57,300	61,000 ^b
FY 2021	TEC	—	11,000	8,000	45,000	64,000 ^b
	OPC ^a	500	200	1,300	—	2,000
	TPC	500	11,200	9,300	45,000	66,000 ^b

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2076

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	81	81	4,050	4,050
Utilities	154	154	7,700	7,700
Maintenance and Repair	170	170	8,500	8,500
Total, Operations and Maintenance	405	405	20,250	20,250

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval; therefore, funding estimates are preliminary.

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at SLAC National Accelerator Laboratory	34,000-45,000
Area of D&D in this project at SLAC National Accelerator Laboratory	8,260
Area at SLAC National Accelerator Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The SLAC Management and Operating (M&O) contractor, Stanford University, will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. Various acquisition alternatives were considered for this project, such as traditional design-bid-build, design-build, and construction manager/general contractor. After considering these alternatives in relation to the schedule, size, and risk, the design-build approach was selected. The M&O contractor’s annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**20-SC-76, Tritium System Demolition and Disposal (TSDD)
Princeton Plasma Physics Laboratory (PPPL)
Project is for Design and Demolition**

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

Summary

The FY 2021 Request for the Tritium System Demolition and Disposal (TSDD) project is \$19,400,000. The current preliminary Total Estimated Cost (TEC) range for this project is \$19,500,000 to \$32,400,000. The current preliminary Total Project Cost (TPC) range for this project is \$20,500,000 to \$33,400,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$33,400,000.

This project will remove tritium contaminated legacy systems at PPPL.

Significant Changes

This project was initiated through FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved September 16, 2019. FY 2021 funds will support Project Engineering and Design (PED) and construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level I: TPC greater than \$5,000,000 and equal to or less than \$50,000,000) will be assigned to this project prior to CD-1 approval.

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	9/16/19	2Q FY 2020 ^a	4Q FY 2020 ^a	4Q FY 2021 ^a	4Q FY 2021	4Q FY 2021 ^a	N/A	2Q FY 2025 ^a

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

Fiscal Year	Performance Baseline Validation
FY 2021	4Q FY 2021 ^a

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^b , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	4,000	28,400 ^a	32,400	1,000	N/A	1,000	33,400 ^a

^a This project is pre-CD-2 approval: therefore, schedule and funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

2. Project Scope and Justification

Scope

The Tritium System Demolition and Disposal (TSDD) project’s scope includes removing tritium contaminated items, components, equipment, and sub-systems, including glove boxes, gas holding tanks, tritium purification system (TPS) process piping, contaminated HVAC ductwork and neutral beam boxes, through demolition and disposal.

Justification

The aging tritium systems pose a risk to personnel at PPPL, are expensive to maintain, and take up valuable space that could be put to better use. The TSDD project will reduce the risk of tritium release, the risk of public or worker radiological exposure, and operating dollars expended on a legacy system, as well as free-up laboratory space for other uses. The project would remove and dispose of the legacy tritium that remains on PPPL by:

- Eliminating risk of tritium release on-site and off-site,
- Eliminating worker exposure to tritium,
- Attenuating operational costs by reducing radiological monitoring, compliance and oversight. This includes greatly reducing the need for (tritium) occupational radiological worker safety requirements (for most of the site) at the conclusion of the work,
- Creating available high value research space.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
PPPL Tritium Areas	<ul style="list-style-type: none"> ▪ Remove and dispose of all of the tritium contaminated process equipment, contaminated ductwork, and waste from PPPL Tritium Areas ▪ Eliminate or reduce surface contamination in contaminated areas 	N/A
TFTR Test Cell (TTC)	<ul style="list-style-type: none"> ▪ Remove, and dispose of tritium-contaminated Neutral Beam Boxes from the TTC — with the exception of any parts identified for re-use on NSTX-U ▪ Remove all Tritium contaminated ductwork ▪ Decontaminate or encapsulate floors and walls. 	N/A

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	4,000	4,000	4,000
Total, Design	4,000	4,000	4,000
Construction			
FY 2020	9,000	9,000	2,000
FY 2021	19,400	19,400	10,000
Outyears	—	—	16,400
Total, Construction	28,400	28,400	28,400
Total Estimated Cost (TEC)			
FY 2020	13,000	13,000	6,000
FY 2021	19,400	19,400	10,000
Outyears	—	—	16,400
Total, TEC^a	32,400	32,400	32,400
Other Project Cost (OPC)			
FY 2019	100	100	100
FY 2020	800	800	800
FY 2021	100	100	100
Total, OPC^b	1,000	1,000	1,000
Total Project Cost (TPC)			
FY 2019	100	100	100
FY 2020	13,800	13,800	6,800
FY 2021	19,500	19,500	10,100
Outyears	—	—	16,400
Total, TPC^a	33,400	33,400	33,400

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	3,200	N/A	N/A
Contingency	800	N/A	N/A
Total, Design	4,000	N/A	N/A
Construction			
Construction	23,400	N/A	N/A
Contingency	5,000	N/A	N/A
Total, Construction	28,400	N/A	N/A
Total, TEC^a	32,400	N/A	N/A
<i>Contingency, TEC</i>	<i>5,800</i>	<i>N/A</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
Conceptual Planning	200	N/A	N/A
Conceptual Design	800	N/A	N/A
Contingency	N/A	N/A	N/A
Total, OPC	1,000	N/A	N/A
<i>Contingency, OPC</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^a	33,400	N/A	N/A
Total, Contingency (TEC+OPC)	5,800	N/A	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Total
FY 2021	TEC	—	13,000	19,400	32,400 ^a
	OPC ^b	100	800	100	1,000
	TPC	100	13,800	19,500	33,400 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	N/A
Expected Useful Life	N/A
Expected Future Start of D&D of this capital asset	N/A

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	N/A	N/A	N/A
Utilities	N/A	N/A	N/A	N/A
Maintenance and Repair	N/A	N/A	N/A	N/A
Total, Operations and Maintenance	N/A	N/A	N/A	N/A

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Princeton Plasma Physics Laboratory	None
Area of D&D in this project at Princeton Plasma Physics Laboratory	13,400
Area at Princeton Plasma Physics Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The PPPL Management and Operating (M&O) Contractor, Princeton University, will perform the acquisition for this project, overseen by the Princeton Site Office. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. It will evaluate various acquisition and project delivery methods prior to achieving CD-1 and potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning and other project scope elements. The M&O Contractor's annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

^a With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**20-SC-77, Argonne Utilities Upgrade Project
Argonne National Laboratory (ANL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Argonne Utilities Upgrade (AU2) project is \$2,000,000. This project has a preliminary Total Estimated Cost (TEC) range of \$72,000,000 to \$215,000,000 and a preliminary Total Project Cost (TPC) range of \$73,000,000 to \$216,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$216,000,000.

AU2 is proposed to revitalize and selectively upgrade ANL’s existing major utility systems including steam, water, sanitary sewer, chilled water, and electrical systems.

Significant Changes

This project was initiated in FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on May 17, 2019. FY 2021 funds will support Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

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	5/17/19	4Q FY 2020 ^a	4Q FY 2020 ^a	4Q FY 2021 ^a	4Q FY 2021 ^a	4Q FY 2022 ^a	N/A	4Q FY 2026 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2021	4Q FY 2021 ^a	1Q FY 2021 ^a	N/A

CD-3A – Approve Long-Lead Procurements and Start of Early Construction

CD-3B – Approve Remaining Construction Activities

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	21,000	194,000	215,000 ^b	1,000	N/A	1,000	216,000 ^b

2. Project Scope and Justification

Scope

The AU2 project is in the pre-conceptual stage of development, and the preliminary scope includes upgrading failing 1940's-era utilities across the ANL campus. These utilities include steam, water, sanitary sewer, chilled water, and electrical systems.

Justification

An efficient, maintainable, and reliable infrastructure is critical to the success and mission capability of ANL's research facilities. As such, there is an urgent mission need to revitalize and selectively upgrade ANL's existing major utility systems including steam, water, sanitary sewer, chilled water and electrical systems.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> ▪ Cooling, Water, Steam, Condensate and Sewer Systems 	<ul style="list-style-type: none"> ▪ Repair, replace or construct new distribution piping for 10,000 linear feet of sewer, potable/non-potable water, steam and condensate piping and support structures (e.g. steam vaults, pipe supports, valves, culverts, etc.) ▪ Replace boiler house control system ▪ Construct new >6,300 ton chilled water plant ▪ Replace or retrofit 4,000 tons of existing chilled water capacity including support infrastructure (e.g. cooling towers, pumps, heat exchangers, etc.) 	<ul style="list-style-type: none"> ▪ Repair, replace or construct new distribution piping for >10,000 linear feet of sewer, potable/non-potable water, steam and condensate piping and support structures (e.g. steam vaults, pipe supports, valves, culverts, etc.) ▪ Install secondary potable water connection to site ▪ Replace or retrofit >4,000 tons of existing chilled water capacity including support infrastructure (e.g. cooling towers, pumps, heat exchangers, etc.)

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project is pre-CD-2; therefore, funding estimates are preliminary.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	35,000	35,000	36,000
Total, Design	37,500	37,500	37,500
Construction			
Outyears	177,500	177,500	177,500
Total, Construction	177,500	177,500	177,500
Total Estimated Cost (TEC)			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	212,500	212,500	213,500
Total, TEC^a	215,000	215,000	215,000
Other Project Cost (OPC)			
FY 2019	100	100	100
FY 2020	600	600	600
FY 2021	300	300	300
Total, OPC^b	1,000	1,000	1,000
Total Project Cost (TPC)			
FY 2019	100	100	100
FY 2020	1,100	1,100	1,100
FY 2021	2,300	2,300	1,300
Outyears	212,500	212,500	213,500
Total, TPC^a	216,000	216,000	216,000

^a This project is pre-CD-2; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	30,000	N/A	N/A
Contingency	7,500	N/A	N/A
Total, Design	37,500	N/A	N/A
Construction			
Construction	142,000	N/A	N/A
Contingency	35,500	N/A	N/A
Total, Construction	177,500	—	—
Total, TEC^a	215,000	N/A	N/A
<i>Contingency, TEC</i>	<i>43,000</i>	—	—
Other Project Cost (OPC)			
OPC except D&D			
OPC Costs	1,000	N/A	N/A
Contingency	—	N/A	N/A
Total, OPC^b	1,000	N/A	N/A
<i>Contingency, OPC</i>	—	N/A	N/A
Total Project Cost^a	216,000	N/A	N/A
Total, Contingency (TEC+OPC)	43,000	N/A	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2021	TEC	—	500	2,000	212,500	215,000 ^a
	OPC ^b	100	600	300	—	1,000
	TPC	100	1,100	2,300	212,500	216,000 ^a

6. Related Operations and Maintenance Funding Requirements

N/A

^a This project is pre-CD-2; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Argonne National Laboratory	None
Area of D&D in this project at Argonne National Laboratory.....	None
Area at Argonne National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

8. Acquisition Approach

The ANL Management and Operating (M&O) Contractor, UChicago Argonne, LLC, will perform the acquisition for this project, overseen by the Argonne Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. The M&O contractor will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-1. Potential acquisition and project delivery methods include, but are not limited to, firm-fixed-price contracts for design-bid-build and design-build. The M&O contractor will also evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. Its annual performance and evaluation measurement plan will include project performance metrics for ANL, on which it will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**20-SC-78, Linear Assets Modernization Project (LAMP)
Lawrence Berkeley National Laboratory (LBNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Linear Assets Modernization Project (LAMP) at LBNL is \$2,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$142,000,000 to \$236,000,000. The Total Project Cost (TPC) range for this project is \$146,000,000 to \$240,000,000. The cost range encompasses the most feasible preliminary alternative at this time. The preliminary TPC estimate for this project is \$240,000,000.

LAMP is proposed to upgrade high priority utility systems to increase the reliability, capability, and safety of LBNL’s infrastructure to meet DOE’s mission. The project will upgrade utility systems, including, but not limited to, domestic water, natural gas, storm drain, sanitary sewer, electrical, and communication.

Significant Changes

This project was initiated the in FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on May 17, 2019. FY 2021 funds will support Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

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	5/17/19	4Q FY 2020 ^a	4Q FY 2020	4Q FY 2021 ^a	3Q FY 2022 ^a	4Q FY 2022 ^a	N/A	4Q FY 2032 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2021	1Q FY 2021 ^a

CD-3A – Approve Long-Lead Procurements and Start of Early Construction

^a This project is pre-CD-2; therefore, funding and schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC^a, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	48,000 ^a	188,000 ^a	236,000 ^a	4,000	N/A	4,000	240,000 ^a

2. Project Scope and Justification

Scope

The Linear Assets Modernization project will implement a multi-system-based, common geographical approach (“corridors” across the lab with a number of different systems included in corridor) to repair, improve, and modernize linear systems which could include domestic water, natural gas, storm drain, sanitary sewer, electrical, and communication. The project will identify locations where utility corridors would provide operational and construction efficiencies while reducing deferred maintenance. The project may also address improvements to roadways or other traffic circulation elements, particularly where utility reconfigurations may necessitate or otherwise provide opportunities for enhancement.

Justification

Established in 1931, LBNL is the oldest DOE national laboratory. SC utilizes the capabilities of LBNL to execute 23 of the 24 core capabilities and the mission of multiple SC program offices, including a strong presence of Advanced Scientific Computing Research, Biological and Environmental Research, Basic Energy Sciences, and High Energy Physics. The mission need of this project is to support the SC mission and multiple scientific programs by increasing the reliability, capability, and safety of LBNL’s underground utility infrastructure while significantly reducing deferred maintenance. Utility infrastructure represents 48 percent of the current \$249,000,000 deferred maintenance backlog and represents a significant capability gap in the LBNL’s ability to provide reliable and safe services to meet DOE’s mission needs. Direct investment is necessary to enable transformational infrastructure improvements to accelerate deferred maintenance reduction, restore operational reliability, and enhance support for scientific advancements. Moreover, existing infrastructure is insufficient to support the future vision of planned facility modernization and growth. Without a modern utility infrastructure backbone, future growth of the science mission at LBNL may not be able to be fully accommodated.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

^a Other Project Costs (OPC) are funded through laboratory overhead.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> ▪ Rehabilitate and selectively upgrade LBNL's existing major underground utility systems 	<ul style="list-style-type: none"> ▪ Renovate and modernize select underground linear corridors containing distribution systems and components for: <ul style="list-style-type: none"> ○ Electrical ○ Natural Gas ○ Domestic water supply/Sanitary /storm water; and/or ○ Data and communication ▪ Establish critical loops for redundancy 	<ul style="list-style-type: none"> ▪ Renovate additional underground corridors

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	45,500	45,500	46,500
Total, Design	48,000	48,000	48,000
Construction			
Outyears	188,000	188,000	188,000
Total, Construction	188,000	188,000	188,000
Total Estimated Cost (TEC)			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	233,500	233,500	234,500
Total, TEC^a	236,000	236,000	236,000
Other Project Cost (OPC)^b			
FY 2019	300	300	300
FY 2020	1,700	1,700	1,700
Outyears	2,000	2,000	2,000
Total, OPC	4,000	4,000	4,000

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)^a			
FY 2019	300	300	300
FY 2020	2,200	2,200	2,200
FY 2021	2,000	2,000	1,000
Outyears	235,500	235,500	236,500
Total, TPC^a	240,000	240,000	240,000

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	38,000	N/A	N/A
Contingency	10,000	N/A	N/A
Total, Design	48,000	N/A	N/A
Construction			
Construction	150,000	N/A	N/A
Contingency	38,000	N/A	N/A
Total, Construction	188,000	N/A	N/A
Total, TEC^a	236,000	N/A	N/A
<i>Contingency, TEC</i>	<i>48,000</i>	<i>N/A</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
Conceptual Design	1,700	N/A	N/A
Start-up	1,600	N/A	N/A
Contingency	700	N/A	N/A
Total, OPC	4,000	N/A	N/A
<i>Contingency, OPC</i>	<i>700</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^a	240,000	N/A	N/A
Total, Contingency (TEC+OPC)	47,700	N/A	N/A

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2021	TEC	—	500	2,000	233,500	236,000 ^a
	OPC ^b	300	1,700	—	2,000	4,000
	TPC	300	2,200	2,000	235,500	240,000 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	TBD
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	N/A

Related Funding Requirements
(dollars in thousands)^c

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	TBD	TBD	TBD	TBD
Utilities	TBD	TBD	TBD	TBD
Maintenance and Repair	TBD	TBD	TBD	TBD
Total, Operations and Maintenance	TBD	TBD	TBD	TBD

7. D&D Information

This project replaces critical infrastructure components; no new construction area is anticipated to be constructed in this project and it will not replace existing facilities.

	Square Feet
New area being constructed by this project at Lawrence Berkeley National Laboratory	None
Area of D&D in this project at Lawrence Berkeley National Laboratory	None
Area at Lawrence Berkeley National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^d
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

^c This project has not received CD-1 approval; related operations and maintenance funding requirements are yet to be determined.

^d With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with the decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

8. Acquisition Approach

The LBNL Management and Operating (M&O) Contractor, University of California, will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. It will evaluate various acquisition approaches and project delivery methods prior to achieving CD-1 and potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. The M&O contractor's annual performance and evaluation measurement plan will include Project performance metrics for LBNL on which it will be evaluated.

**20-SC-79, Critical Utilities Infrastructure Revitalization (CUIR)
SLAC National Accelerator Laboratory (SLAC)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Critical Utilities Infrastructure Revitalization (CUIR) project is \$2,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$80,000,000 to \$186,000,000. The preliminary Total Project Cost (TPC) range for this project is \$83,000,000 to \$189,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$189,000,000.

The primary objective of this project is to close utilities infrastructure gaps to support multi-program science missions at SLAC. Evolving technologies, instruments, experimental parameters, sensitivities, and complexity require increased reliability, resiliency, and service levels in electrical, mechanical, and civil systems site wide. The CUIR project will address the critical campus-wide utility and infrastructure issues by replacing, repairing, and modernizing the highest risk water/fire protection, sanitary sewer, storm drain, electrical, and cooling water system deficiencies. These needs have been identified through condition assessments, inspections, and recommendations from subject matter experts responsible for stewardship of the systems.

Significant Changes

This project was initiated in FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved May 17, 2019. FY 2021 funds will support Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

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	5/17/19	4Q FY 2020 ^a	4Q FY 2020 ^a	4Q FY 2021 ^a	3Q FY 2022 ^a	4Q FY 2022 ^a	N/A	4Q FY 2032 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2021 ^a	1Q FY 2021 ^a

CD-3A – Approve Long-Lead Procurements, Original Scope

^a This project has not received CD-2 approval; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC^a, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	20,000	166,000 ^b	186,000	3,000	N/A	3,000	189,000 ^b

2. Project Scope and Justification

Scope

CUIR's preliminary scope is to provide underground domestic water/fire protection, sanitary sewer, and storm drain systems site-wide. Additionally, it will provide updated major electrical gear, instrumentation, and cooling water systems for the two-mile long klystron gallery and accelerator housing constructed in 1962.

Justification

SLAC is currently implementing a Campus Strategy based on its goals, which are designed to support the DOE Science Mission, increase reliability, and minimize costs through safe, effective, and efficient operations. The objective of the CUIR project is to reduce risks and close the capability gaps identified in SLAC's infrastructure assessments and surveys as they relate to storm water, sanitary sewer, domestic water/fire protection, electrical, and cooling water systems.

Disruptions caused by utility piping breaks, power fluctuations, faults, and cooling water interruptions, have frequently impacted science research site wide. Electrical systems, pumps, and motors fail, valves on piping systems freeze, and there are inoperable or unsafe electrical components that require broad outages to respond and repair, which impact more science research and the greater SLAC population. Work-arounds and administrative controls placed on existing equipment and systems, which are under-rated, not operating as intended, or not designed/operational for today's science needs, create tremendous inefficiencies and safety concerns, and sub-optimize operations.

The proposed project will retire \$18,000,000 in deferred maintenance. The timely delivery of this project is essential for current and future success of SLAC's science programs. Alternatives will be evaluated prior to CD-1 during acquisition strategy development.

The CUIR project will also reduce operational risks in critical infrastructure and utility support systems for all science programs, decrease utilization of unique, old and outdated equipment; and increase operational reliability, flexibility, and sustainability throughout our site infrastructure. If these existing reliability gaps are not fulfilled, the operational efficiency, reliability, productivity, and competitive viability in science programs and other related science research breakthroughs will continue to be impeded.

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*.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval; therefore, funding estimates are preliminary.

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> ▪ Deliver identified underground utility capabilities 	<ul style="list-style-type: none"> ▪ Repair/Replace 1,500 linear feet (LF) sanitary sewer piping and one lift station. ▪ Repair/Replace 9,000 LF of domestic water/ fire protection piping. ▪ Repair/Replace 1,500 LF of storm water drain piping and one lift station. 	<ul style="list-style-type: none"> ▪ Repair/Replace 5,000 LF of sanitary sewer piping and two lift stations. ▪ Repair/Replace 28,000 LF of domestic water/ fire protection piping. ▪ Repair/Replace 6,000 LF of storm water drain piping and three lift stations.
<ul style="list-style-type: none"> ▪ Deliver identified cooling capabilities 	<ul style="list-style-type: none"> ▪ Provides one new 5 megawatt (MW) cooling towers at Linac ▪ Increase the existing underground cooling tower header pipe capacity to 18 inches. 	<ul style="list-style-type: none"> ▪ Provides two new 5 MW cooling towers at Linac. ▪ Increase the existing underground cooling tower header pipe capacity to 20 inches. ▪ Install new non-radioactive Low Conductivity Water systems for cooling at sectors 4-10 ▪ Provide new controls and instrumentation for the LCW system at sectors 4-10
<ul style="list-style-type: none"> ▪ Deliver identified electrical power capabilities 	<ul style="list-style-type: none"> ▪ Replace one Motor Control Center on Linac ▪ Replace five electrical switchgear in substations in Linac ▪ Install two new 12 kilovolt (kV) electrical feeder and switching equipment for Linac ▪ Provide partial SCADA (supervisory control and data acquisition) for of the SLAC power system in master substation and Linac 	<ul style="list-style-type: none"> ▪ Replace twelve Motor Control Centers on Linac ▪ Replace sixteen electrical switchgear in substations in Linac ▪ Replace six 12kV electrical feeders across site ▪ Provide complete SCADA of the SLAC power system in master substation and Linac

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	35,000	35,000	36,000
Total, Design	37,500	37,500	37,500
Construction			
Outyears	148,500	148,500	148,500
Total, Construction	148,500	148,500	148,500
Total Estimated Cost (TEC)			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	183,500	183,500	184,500
Total, TEC^a	186,000	186,000	186,000
Other Project Cost (OPC)			
FY 2020	1,000	1,000	1,000
FY 2021	1,000	1,000	1,000
Outyears	1,000	1,000	1,000
Total, OPC^b	3,000	3,000	3,000
Total Project Cost (TPC)			
FY 2020	1,500	1,500	1,500
FY 2021	3,000	3,000	2,000
Outyears	184,500	184,500	185,500
Total, TPC^a	189,000	189,000	189,000

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	16,000	N/A	N/A
Contingency	4,000	N/A	N/A
Total, Design	20,000	N/A	N/A
Construction			
Construction	132,000	N/A	N/A
Contingency	34,000	N/A	N/A
Total, Construction	166,000	N/A	N/A
Total, TEC^a	186,000	N/A	N/A
<i>Contingency, TEC</i>	<i>38,000</i>	<i>N/A</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
OPC except D&D	3,000	N/A	N/A
Contingency	—	N/A	N/A
Total, OPC	3,000	N/A	N/A
<i>Contingency, OPC</i>	<i>—</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^a	189,000	N/A	N/A
<i>Total, Contingency (TEC+OPC)</i>	<i>38,000</i>	<i>N/A</i>	<i>N/A</i>

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2020	FY 2021	Outyears	Total
FY 2021	TEC	500	2,000	183,500	186,000 ^a
	OPC ^b	1,000	1,000	1,000	3,000
	TPC	1,500	3,000	184,500	189,000 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2076

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	7,805	N/A	885,000
Utilities	N/A	14,940	N/A	158,930
Maintenance and Repair	N/A	5,700	N/A	702,000
Total, Operations and Maintenance	N/A	28,445	N/A	1,745,930

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at SLAC National Accelerator Facility	None
Area of D&D in this project at SLAC National Accelerator Facility	None
Area at SLAC National Accelerator Facility to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

8. Acquisition Approach

The SLAC Management and Operating (M&O) contractor, Stanford University, will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. The M&O contractor will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-1. Potential acquisition and project delivery methods include, but are not limited to, firm-fixed-price contracts for design-bid-build, construction management, and design-build subcontracts. The M&O contractor will also evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning and other project scope elements. Its annual performance and evaluation measurement plan will include project performance metrics for SLAC on which it will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**20-SC-80, Utilities Infrastructure Project
Fermi National Accelerator Laboratory (FNAL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Utilities Infrastructure Project (UIP) is \$2,000,000. This project has a preliminary Total Estimated Cost (TEC) range of \$146,000,000 to \$310,000,000 and a preliminary Total Project Cost (TPC) range of \$150,000,000 to \$314,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$314,000,000.

This project will modernize aging, obsolete, and severely deteriorated utilities infrastructure at Fermi National Accelerator Laboratory (FNAL).

Significant Changes

This project was initiated in FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on May 17, 2019. FY 2021 funds will support Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

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	5/17/19	4Q FY 2020	4Q FY 2020 ^a	4Q FY 2021 ^a	3Q FY 2022 ^a	4Q FY 2022 ^a	N/A	4Q FY 2034 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2021 ^a	4Q FY 2020 ^a

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC^a, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2021	73,000	237,000 ^b	310,000	4,000	N/A	4,000	314,000 ^b

2. Project Scope and Justification

Scope

The UIP's preliminary scope includes upgrading the highest risk major utility systems across the FNAL campus. Specifically, this project will first evaluate the current condition of the industrial cooling water system, potable water distribution system, sanitary sewer and storm collection systems, natural gas distribution system, electrical distribution system, and the Central Utility Building. Selected portions of the systems will then be replaced to assure safe, reliable, and efficient service to mission critical facilities. In addition, the project will perform upgrades to obsolete, end-of-life components, which will increase capacity, reliability, and personnel safety for critical utilities.

Justification

DOE's Office of Science (SC) advances new experiments, international partnerships, and research programs to transform the understanding of nature and to advance U.S. energy, economic and national security interests. This mission requires the modernization of aging, obsolete, and severely deteriorated utilities infrastructure at FNAL. SC has identified a need to recapitalize FNAL's Central Utilities Building and distributed site utility infrastructure to ensure the stewardship of SC's investments and to provide modern, world-class facilities for scientific experiments and research.

Although there has been substantial investment in recent years to modernize and construct new research facilities at FNAL, much of FNAL's utility infrastructure serving these facilities is over 50 years old. Efficient, maintainable, and reliable utilities are critical to the success and mission capability of FNAL's research facilities. Currently, a significant portion of FNAL's utility infrastructure is beyond useful life and suffering from failures, decreased reliability, lack of redundancy, and limitations in capacity. As such, there is an urgent need to revitalize and selectively upgrade FNAL's existing major utility systems to ensure reliable service, meet capacity requirements, and enable readiness of facilities critical to the research mission.

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*.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> ▪ Rehabilitate and selectively upgrade FNAL’s existing major utility systems 	<ul style="list-style-type: none"> ▪ Revitalize 20% of the Industrial Cooling Water (ICW) system extending from backbone ▪ Replace 70% of the Domestic Water System (DWS) identified as inadequate or sub-standard ▪ Replace 50% of the Sanitary Sewer & Storm Collection systems identified as inadequate or sub-standard ▪ Replace 2 miles of underground Natural Gas lines ▪ Provide necessary repairs to the Central Utility Building (CUB) to ensure viability for current and near future (PIP-II, IERC, LBNF-Dune) projects 	<ul style="list-style-type: none"> ▪ Revitalize 60% of the Industrial Cooling Water (ICW) system extending from backbone ▪ Replace 100% of the Domestic Water System (DWS) identified as inadequate or sub-standard ▪ Replace 100% of the Sanitary Sewer & Storm Collection systems identified as inadequate or sub-standard ▪ Replace 22 miles of underground Natural Gas lines ▪ Provide Safety / Reliability upgrades to Kautz Road Substation ▪ Replace Central Utility Building

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	70,500	70,500	71,500
Total, Design	73,000	73,000	73,000
Construction			
Outyears	237,000	237,000	237,000
Total, Construction	237,000	237,000	237,000
Total Estimated Cost (TEC)			
FY 2020	500	500	500
FY 2021	2,000	2,000	1,000
Outyears	307,500	307,500	308,500
Total, TEC^a	310,000	310,000	310,000

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	100	100	26
FY 2020	1,900	1,900	1,974
Outyears	2,000	2,000	2,000
Total, OPC^a	4,000	4,000	4,000
Total Project Cost (TPC)			
FY 2019	100	100	26
FY 2020	2,400	2,400	2,474
FY 2021	2,000	2,000	1,000
Outyears	309,500	309,500	310,500
Total, TPC^b	314,000	314,000	314,000

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	60,800	N/A	N/A
Contingency	12,200	N/A	N/A
Total, Design	73,000	N/A	N/A
Construction			
Construction	197,500	N/A	N/A
Contingency	39,500	N/A	N/A
Total, Construction	237,000	N/A	N/A
Total, TEC^b	310,000	N/A	N/A
<i>Contingency, TEC</i>	<i>51,700</i>	<i>N/A</i>	<i>N/A</i>

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Other Project Cost (OPC)			
OPC except D&D			
OPC except D&D	3,300	N/A	N/A
Contingency	700	N/A	N/A
Total, OPC^a	4,000	N/A	N/A
<i>Contingency, OPC</i>	<i>700</i>	<i>N/A</i>	<i>N/A</i>
Total Project Cost^b	314,000	N/A	N/A
Total, Contingency (TEC+OPC)	52,400	N/A	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2021	TEC	—	500	2,000	307,500	310,000 ^b
	OPC ^a	100	1,900	—	2,000	4,000
	TPC	100	2,400	2,000	309,500	314,000 ^b

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	TBD ^c
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	TBD ^c

Related Funding Requirements^c

(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	TBD	TBD	N/A	TBD
Utilities	TBD	TBD	TBD	TBD
Maintenance and Repair	TBD	TBD	TBD	TBD
Total, Operations and Maintenance	TBD	TBD	TBD	TBD

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^c This project has not received CD-1 approval; the related operations and maintenance funding requirements are yet to be determined.

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Fermi National Accelerator Laboratory.....	TBD
Area of D&D in this project at Fermi National Accelerator Laboratory.....	TBD
Area at Fermi National Accelerator Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	TBD

8. Acquisition Approach

The FNAL Management and Operating (M&O) contractor, Fermi Research Alliance LLC, will perform the acquisition for this project. The M&O contractor is responsible for awarding and managing all subcontracts related to this project and will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-1. The M&O will also evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. Its annual performance and evaluation measurement plan will include project performance metrics for FNAL on which will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**19-SC-71, Science User Support Center
Brookhaven National Laboratory (BNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Science User Support Center (SUSC) is \$7,000,000. This project has a preliminary Total Estimated Cost (TEC) range of \$70,800,000 to \$94,800,000 and a preliminary Total Project Cost (TPC) range of \$72,000,000 to \$96,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$86,200,000.

This project will provide a facility to serve the research community and improve scientific and operational productivity by consolidating visitor and support services.

Significant Changes

This project was initiated in FY 2019. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on December 18, 2018. FY 2021 funds will support construction and associated activities.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) has been assigned to this project.

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 2019	12/12/16	4Q FY 2018	2Q FY 2019 ^a	4Q FY 2020 ^a	3Q FY 2021	4Q FY 2021 ^a	N/A	4Q FY 2025 ^a
FY 2020	12/12/16	9/07/18	12/18/18	4Q FY 2020 ^a	3Q FY 2021	4Q FY 2021 ^a	N/A	4Q FY 2025 ^a
FY 2021	12/12/16	9/07/18	12/18/18	4Q FY 2020 ^a	3Q FY 2021	3Q FY 2021 ^a	N/A	4Q FY 2026 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2019	4Q FY 2020	N/A
FY 2020	4Q FY 2020	4Q FY 2019
FY 2021	4Q FY 2020 ^a	4Q FY 2020 ^a

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

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2019	9,400	75,600 ^b	85,000 ^b	1,000	N/A	1,000	86,000 ^b
FY 2020	9,400	75,600 ^b	85,000 ^b	1,200	N/A	1,200	86,200 ^b
FY 2021	9,400	75,600 ^b	85,000 ^b	1,200	N/A	1,200	86,200 ^b

2. Project Scope and Justification

Scope

The scope of the SUSC project is to construct a multi-story office building of approximately 70,000 to 120,000 gross square feet (gsf) to consolidate and provide space for visitor processing, offices for approximately 200-350 occupants, space for conferences, extension of utilities to the building, and related roadway modifications and parking lot development. Demolition of excess facilities to meet offsetting space requirements will be done off-project, unless specific facilities are required to be included on-project. Additional supporting functions such as utilities or site modifications may be included in the project, if they are deemed necessary.

Justification

Brookhaven National Laboratory (BNL) has nine user facilities that attract over 40,000 visiting scientists, guests, users, and contractors annually to conduct research in a broad range of basic and applied sciences; however, the ability to efficiently process and support the needs of this growing community of researchers is limited by the age, condition, and dispersed nature of BNL’s current facilities. The laboratory’s scientific impact can be improved by a facility that centralizes its administrative support functions and provides easier visitor access to conferencing and collaboration space to support the Office of Science (SC) research mission. BNL also has many World War II era facilities dispersed around the site that house research support organizations in deteriorated facilities that are no longer sustainable and contribute to operational inefficiencies. Construction of the SUSC is conceived to provide convenient and efficient facilities for processing and supporting the users of BNL’s premier research facilities, which would enable for the demolition of the current substandard, dispersed, and inefficient facilities. It will also provide conference facilities to support the collaborative science and research mission for the user community and BNL scientists.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Multi-story Building	70,000 gsf	120,000 gsf

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs^a
Total Estimated Cost (TEC)			
Design			
FY 2019	7,000	7,000	398
FY 2020	2,400	2,400	9,002
Total, Design	9,400	9,400	9,400
Construction			
FY 2020	17,600	17,600	4,000
FY 2021	7,000	7,000	16,000
Outyears	51,000	51,000	55,600
Total, Construction	75,600	75,600	75,600
Total Estimated Cost (TEC)			
FY 2019	7,000	7,000	398
FY 2020	20,000	20,000	13,002
FY 2021	7,000	7,000	16,000
Outyears	51,000	51,000	55,600
Total, TEC^b	85,000	85,000	85,000
Other Project Cost (OPC)			
FY 2017	700	700	700
FY 2018	300	300	286
FY 2019	200	200	214
Total, OPC^c	1,200	1,200	1,200
Total Project Cost (TPC)			
FY 2017	700	700	700
FY 2018	300	300	286
FY 2019	7,200	7,200	612
FY 2020	20,000	20,000	13,002
FY 2021	7,000	7,000	16,000
Outyears	51,000	51,000	55,600
Total, TPC^b	86,200	86,200	86,200

^a Costs through 2019 reflect actual Costs; costs for FY 2020 and the outyears are estimates.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^c Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	7,800	7,800	N/A
Contingency	1,600	1,600	N/A
Total, Design	9,400	9,400	N/A
Construction			
Construction	63,000	63,000	N/A
Contingency	12,600	12,600	N/A
Total, Construction	75,600	75,600	N/A
Total, TEC^a	85,000	85,000	N/A
<i>Contingency, TEC</i>	<i>14,200</i>	<i>14,200</i>	<i>N/A</i>
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	500	500	N/A
Conceptual Design	500	500	N/A
Contingency	200	200	N/A
Total, OPC^b	1,200	1,200	N/A
<i>Contingency, OPC</i>	<i>200</i>	<i>200</i>	<i>N/A</i>
Total Project Cost^a	86,200	86,200	N/A
<i>Total, Contingency (TEC+OPC)</i>	<i>14,400</i>	<i>14,400</i>	<i>N/A</i>

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2019	TEC	—	2,000	7,400	—	75,600	85,000 ^a
	OPC ^b	1,000	—	—	—	—	1,000
	TPC	1,000	—	7,400	—	75,600	86,000 ^a
FY 2020	TEC	—	7,000	6,400	—	71,600	85,000 ^a
	OPC ^b	1,000	200	—	—	—	1,200
	TPC	1,000	7,200	6,400	—	71,600	86,200 ^a
FY 2021	TEC	—	7,000	20,000	7,000	51,000	85,000 ^a
	OPC ^b	1,000	200	—	—	—	1,200
	TPC	1,000	7,200	20,000	7,000	51,000	86,200 ^a

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	60 years
Expected Future Start of D&D of this capital asset	4Q FY 2086

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	166	166	8,307	8,307
Utilities	78	78	3,879	3,879
Maintenance and Repair	384	384	19,200	19,200
Total, Operations and Maintenance	628	628	31,386	31,386

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Brookhaven National Laboratory	70,000 - 120,000
Area of D&D in this project at Brookhaven National Laboratory	None
Area at Brookhaven National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	70,000 - 120,000

8. Acquisition Approach

The BNL Management and Operating (M&O) Contractor, Brookhaven Science Associates, will perform the acquisition for this project, overseen by the Brookhaven Site Office and will be responsible for awarding and managing all subcontracts related to the project. The M&O contractor evaluated various acquisition and project delivery methods prior to achieving CD-1 and selected a Construction Manager/General Contractor approach as the best method to deliver the project. The M&O Contractor will evaluate potential benefits of using single or multiple contracts for site preparation activities. The M&O Contractor’s annual performance and evaluation measurement plan includes Project performance metrics on which it will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**19-SC-73, Translational Research Capability
Oak Ridge National Laboratory (ORNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Translational Research Capability (TRC) project is \$10,000,000. The preliminary Total Estimated Cost (TEC) range for this project is of \$80,300,000 to \$93,500,000. The preliminary Total Project Cost (TPC) range for this project is \$81,800,000 to \$95,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$95,000,000.

This project will provide laboratory, high bay, office, and collaboration space to support advancement in high-performance computing and materials science in support of multidisciplinary research.

Significant Changes

This project was initiated in FY 2019. The most recent DOE Order 413.3B Critical Decision (CD) is CD-3A, Approve Long-Lead Procurements and Start of Early Construction Activities, which was approved on February 05, 2019. FY 2021 funds will support construction and associated activities.

A Federal Project Director with the appropriate certification (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) has been assigned to this project.

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 2020	10/26/17	7/20/18	11/02/18 ^a	1Q FY 2020 ^a	4Q FY 2019	1Q FY 2020 ^a	N/A	4Q FY 2025 ^a
FY 2021	10/26/17	7/20/18	11/02/18 ^a	3Q FY 2020 ^a	4Q FY 2019	3Q FY 2020 ^a	N/A	4Q FY 2025 ^a

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

Fiscal Year	Performance Baseline Validation	CD-3A	CD-2/3	CD-3B
FY 2020	N/A	2Q FY 2019	1Q FY 2020 ^a	N/A
FY 2021	N/A	2/05/19	3Q FY 2020 ^a	N/A

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

CD-3A – Approve Long-Lead Procurements, Original Scope

CD-3B – Approve Long-Lead Procurements, Revised Scope

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2020	9,700	83,800	93,500 ^b	1,500	N/A	1,500	95,000 ^b
FY 2021	7,400	86,100	93,500 ^b	1,500	N/A	1,500	95,000 ^b

2. Project Scope and Justification

Scope

The scope of the TRC project is to provide 79,700 to 115,000 gross square feet (gsf) of laboratory, high bay, office, and collaboration space to support advancement in high-performance computing and materials science in support of multidisciplinary research. Additional supporting functions such as utilities or site modifications may be included in the project, if they are deemed necessary.

Justification

The Office of Science (SC) has 24 core capabilities distributed across ten of the world-class national laboratories with the following four core capabilities that are relevant to this project in support of the SC mission at Oak Ridge National Laboratory (ORNL): advanced computer science, visualization, and data; materials science and engineering; decision science and analysis; and plasma and fusion energy science. Several SC Advisory Committee reports support the continuing need for these core capabilities encouraging development and integration of several multidisciplinary efforts, such as developing computational tools and the increasing necessity for interdisciplinary collaboration. This project will provide modern, flexible, and adaptable space that is that will enable ORNL to respond to the pressing demand to support advancement in computing and materials science in support of multidisciplinary research.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Multifunction Laboratory and Office Building	79,700 gsf	115,000 gsf

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval, therefore, funding estimates are preliminary.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2019	7,400	7,400	460
FY 2020	—	—	4,000
FY 2021	—	—	2,940
Total, Design	7,400	7,400	7,400
Construction			
FY 2019	17,600	17,600	1,900
FY 2020	25,000	25,000	3,100
FY 2021	10,000	10,000	30,000
Outyears	33,500	33,500	51,100
Total, Construction	86,100	86,100	86,100
Total Estimated Cost (TEC)			
FY 2019	25,000	25,000	2,360
FY 2020	25,000	25,000	7,100
FY 2021	10,000	10,000	32,940
Outyears	33,500	33,500	51,100
Total, TEC^a	93,500	93,500	93,500
Other Project Cost (OPC)^b			
OPC except D&D			
FY 2017	190	190	190
FY 2018	1,000	1,000	1,000
FY 2019	210	210	89
Outyears	100	100	221
Total, OPC	1,500	1,500	1,500
Total Project Cost (TPC)			
FY 2017	190	190	190
FY 2018	1,000	1,000	1,000
FY 2019	25,210	25,210	2,449
FY 2020	25,000	25,000	7,100
FY 2021	10,000	10,000	32,940
Outyears	33,600	33,600	51,321
Total, TPC^a	95,000	95,000	95,000

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)^a			
Design			
Design	6,400	8,200	N/A
Contingency	1,000	1,500	N/A
Total, Design	7,400	9,700	N/A
Construction			
Construction	70,100	70,500	N/A
Contingency	16,000	13,300	N/A
Total, Construction	86,100	83,800	N/A
Total, TEC	93,500	93,500	N/A
<i>Contingency, TEC</i>	<i>17,000</i>	<i>14,800</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
Conceptual Planning	500	500	N/A
Conceptual Design	800	800	N/A
Contingency	200	200	N/A
Total, OPC	1,500	1,500	N/A
<i>Contingency, OPC</i>	<i>200</i>	<i>200</i>	<i>N/A</i>
Total Project Cost^a	95,000	95,000	N/A
Total, Contingency (TEC+OPC)	17,200	15,000	N/A

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	—	25,000	15,000	—	53,500	93,500 ^a
	OPC ^b	1,190	—	—	—	310	1,500
	TPC	1,190	25,000	15,000	—	53,810	95,000 ^a
FY 2021	TEC	—	25,000	25,000	10,000	33,500	93,500 ^a
	OPC ^b	1,190	210	—	—	100	1,500
	TPC	1,190	25,210	25,000	10,000	33,600	95,000 ^a

^a This project has not received CD-2 approval, therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2025
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2075

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	—	742	—	26,823
Utilities	—	258	—	9,030
Maintenance and Repair	—	720	—	25,201
Total, Operations and Maintenance	—	1,720	—	61,054

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Oak Ridge National Laboratory	79,700-115,000
Area of D&D in this project at Oak Ridge National Laboratory	None
Area at Oak Ridge National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	79,700-115,000

8. Acquisition Approach

The ORNL Management and Operating (M&O) Contractor, UT-Battelle, will perform the acquisition for this project overseen by the ORNL Site Office and will be responsible for awarding and managing all subcontracts related to the project. The M&O contractor evaluated various acquisition and project delivery methods prior to achieving CD-1, and selected a design/build best value technical qualification approach as the best method to deliver the project. The ORNL M&O Contractor will evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning and other project scope elements. The M&O Contractor’s annual performance and evaluation measurement plan includes project performance metrics on which it will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**19-SC-74, Biological and Environmental Program Integration Center (BioEPIC)
Lawrence Berkeley National Laboratory (LBNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Biological and Environmental Program Integration Center (BioEPIC) project is \$6,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$110,000,000 to \$190,000,000. The preliminary Total Project Cost (TPC) range for this project is \$112,200,000 to \$192,200,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for the project is \$142,200,000.

This project will construct a new building with high performance laboratory space in close proximity to key LBNL facilities and programs. Research operations currently located in commercially leased space and dispersed across the campus will be collocated into this building allowing for better facilitation of Biological and Environmental Research (BER), Advanced Scientific Computing Research (ASCR), and Basic Energy Sciences (BES) program research activities.

Significant Changes

This project was initiated in FY 2019. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on May 9, 2019. FY 2021 funds will support construction and associated activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level III: TPC greater than \$100,000,000 and equal to or less than \$400,000,000) has been assigned to this project.

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 2020	3/13/18	2Q FY 2019	3Q FY 2019	4Q FY 2020 ^a	2Q FY 2022 ^a	4Q FY 2021 ^a	N/A	4Q FY 2027 ^a
FY 2021	3/13/18	5/09/19	5/09/19	4Q FY 2021 ^a	2Q FY 2021 ^a	4Q FY 2021 ^a	N/A	4Q FY 2027 ^a

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

Fiscal Year	Performance Baseline Validation
FY 2020	4Q FY 2020 ^a
FY 2021	4Q FY 2021 ^a

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2020	13,000 ^b	127,000 ^b	140,000 ^b	2,200	N/A	2,200	142,200 ^b
FY 2021	13,000 ^b	127,000 ^b	140,000 ^b	2,200	N/A	2,200	142,200 ^b

2. Project Scope and Justification

Scope

The scope of the BioEPIC project is to construct a new, state-of-the-art facility between 55,000 and 90,000 gross square feet (gsf) with laboratory space to support high performance research by BER, ASCR, and BES programs. This facility will be constructed in close proximity to key LBNL facilities and programs. Research operations currently located in commercially leased space and dispersed across the campus will be collocated to the BioEPIC building. Collocation of researchers in this unique experimental facility, near other important Office of Science (SC) assets, will increase synergy and efficiency, which will better facilitate collaborative research in support of the SC mission.

Justification

The mission need of this project is to increase the synergy and efficiency of biosciences and other SC research at LBNL. LBNL has grown from a pioneering particle and nuclear physics laboratory into a multidisciplinary research facility with broad capabilities in physical, chemical, computational, biological, and environmental systems research in support of the DOE mission. Much of the biological sciences program at LBNL is located off-site, away from the main laboratory, while others are dispersed across several locations on the LBNL campus. This arrangement has produced research and operational capability gaps that limit scientific progress and is a significant roadblock to the kind of collaborative science that is required for understanding, predicting, and harnessing the Earth’s microbiome for energy and environmental benefits. This project will close the present capability gap by providing a state-of-the-art facility that will collocate biosciences research and other programs.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Biosciences and other research space	55,000 gsf	90,000 gsf

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval; therefore, funding estimates are preliminary.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2019	5,000	5,000	5,000
FY 2020	8,000	8,000	8,000
Total, Design	13,000	13,000	13,000
Construction			
FY 2020	7,000	7,000	—
FY 2021	6,000	6,000	8,000
Outyears	114,000	114,000	119,000
Total, Construction	127,000	127,000	127,000
Total Estimated Cost (TEC)			
FY 2019	5,000	5,000	5,000
FY 2020	15,000	15,000	8,000
FY 2021	6,000	6,000	8,000
Outyears	114,000	114,000	119,000
Total, TEC^a	140,000	140,000	140,000
Other Project Cost (OPC)^b			
FY 2019	1,500	1,500	1,500
Outyears	700	700	700
Total, OPC	2,200	2,200	2,200
Total Project Cost (TPC)^a			
FY 2019	6,500	6,500	6,500
FY 2020	15,000	15,000	8,000
FY 2021	6,000	6,000	8,000
Outyears	114,700	114,700	119,700
Total, TPC^a	142,200	142,200	142,200

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	10,600	12,800	N/A
Contingency	2,400	3,200	N/A
Total, Design	13,000	16,000	N/A
Construction			
Construction	105,000	103,000	N/A
Contingency	22,000	21,000	N/A
Total, Construction	127,000	124,000	N/A
Total, TEC^a	140,000	140,000	N/A
<i>Contingency, TEC</i>	<i>24,400</i>	<i>24,200</i>	<i>N/A</i>
Other Project Cost (OPC)^b			
OPC except D&D			
Conceptual Design	1,500	1,300	N/A
Start-up	600	600	N/A
Contingency	100	300	N/A
Total, OPC	2,200	2,200	N/A
<i>Contingency, OPC</i>	<i>100</i>	<i>300</i>	<i>N/A</i>
Total Project Cost^a	142,200	142,200	N/A
<i>Total, Contingency (TEC+OPC)</i>	<i>24,500</i>	<i>24,500</i>	<i>N/A</i>

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	5,000	6,000	—	129,000	140,000 ^a
	OPC ^b	1,500	—	—	700	2,200
	TPC	6,500	6,000	—	129,700	142,200 ^a
FY 2021	TEC	5,000	15,000	6,000	114,000	140,000 ^a
	OPC ^b	1,500	—	—	700	2,200
	TPC	6,500	15,000	6,000	114,700	142,200 ^a

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2027
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2077

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	150	150	5,700	5,700
Utilities	270	270	11,900	11,900
Maintenance and Repair	530	530	20,600	20,600
Total, Operations and Maintenance	950	950	38,200	38,200

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Lawrence Berkeley National Laboratory	55,000 -90,000
Area of D&D in this project at Lawrence Berkeley National Laboratory	None
Area at Lawrence Berkeley National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The LBNL Management and Operating (M&O) Contractor, University of California, will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor evaluated various acquisition approaches and project delivery methods prior to achieving CD-1 and selected a tailored Design-Bid-Build approach with a Construction Manager as General Contractor as the overall best project delivery method with the lowest risk to DOE. The M&O contractor is also responsible for awarding and administering all subcontracts related to this project. The M&O contractor’s annual performance evaluation and measurement plan includes project performance metrics on which it will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**18-SC-71, Energy Sciences Capability
Pacific Northwest National Laboratory (PNNL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Energy Sciences Capability project is \$23,000,000. The Total Estimated Cost (TEC) for this project is \$90,000,000 and the Total Project Cost (TPC) for this project is \$93,000,000.

This project will provide a facility for the consolidation of multidisciplinary efforts related to the advancement of catalysis science which are currently located in multiple facilities, on and off the PNNL Richland campus.

Significant Changes

This project was initiated in FY 2018. The most recent DOE Order 413.3B Critical Decision (CD) is CD-2/3, Approve Performance Baseline and Approve Start of Construction, which was approved on December 7, 2018. FY 2021 funds will support construction and associated activities.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) has been assigned to this project.

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 2018	12/12/16	N/A	4Q FY 2018	4Q FY 2019	N/A	4Q FY 2020	N/A	4Q FY 2025
FY 2019	12/12/16	3Q FY 2018	2Q FY 2018	4Q FY 2019	4Q FY 2019	4Q FY 2019	N/A	4Q FY 2025
FY 2020	12/12/16	3Q FY 2018	2/13/18	12/07/18	12/07/18	12/07/18	N/A	12/31/23
FY 2021	12/12/16	2/13/18	2/13/18	12/07/18	12/07/18	12/07/18	N/A	4Q FY 2023

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

Fiscal Year	Performance Baseline Validation
FY 2018	4Q FY 2019
FY 2019	4Q FY 2019
FY 2020	12/07/18
FY 2021	12/07/18

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	9,000	81,000	90,000	3,000	N/A	3,000	93,000
FY 2019	9,000	81,000	90,000	3,000	N/A	3,000	93,000
FY 2020	9,000	81,000	90,000	3,000	N/A	3,000	93,000
FY 2021	9,000	81,000	90,000	3,000	N/A	3,000	93,000

2. Project Scope and Justification

Scope

The scope of the proposed ESC project is to design, construct and turnover facilities and infrastructure that nominally provides 110,000 to 145,000 gross square feet of wet chemistry, instrumentation, and computational space in 40 to 52 laboratory modules along with offices for 150 to 200 research and support staff.

Justification

PNNL operates facilities for research in chemistry, materials sciences, subsurface science, biology, physics, medicine, and applied science, as well as for the study of a diverse range of advanced technologies. PNNL’s science mission, which supports DOE’s mission, is to understand, predict, and control complex adaptive systems for earth, energy, and security missions. PNNL’s recognized Core Capabilities are essential to advance and accelerate SC research sponsored by BES, BER, and ASCR. All of these research areas benefit from multidisciplinary approaches that accelerate scientific advances.

The objective behind the ESC project is to increase the impact of chemical conversion research and development at PNNL and expand the reach of user programs. Ultimately, PNNL requires greater multidisciplinary collaboration, controlled environments, and increasing computational needs beyond current capabilities to accomplish this end state. Currently, key PNNL staff members and instrumentation driving multidisciplinary efforts are located in multiple facilities, separated miles apart, on and off of the PNNL Richland campus. With less than 0.25percent vacant lab space and less than 1.5 percent vacant office space currently available and scattered across the campus, PNNL needs a new facility to allow for collaboration. This consolidation will free up space that also allows for increased optimization and greater colocation of Environmental Molecular Sciences Laboratories and Atmospheric Radiation Measurement user missions.

The geographic separation of scientific capabilities at PNNL creates a capability gap by impacting collaborative work and limits interdisciplinary research required to realize the critical advances offered through integration (i.e., “convergence”). As stated in the report “The Convergence of the Life Sciences, Physical Sciences, and Engineering”^b from the Massachusetts Institute of Technology, convergence “involves the coming together of different fields of study—particularly engineering, physical sciences, and life sciences—through collaboration among research groups and the integration of approaches” and “is a new paradigm that can yield critical advances in a broad array of sectors, from health care to energy, food, climate, and water.” It also entails “a broad rethinking of how all scientific research can be conducted, so that we capitalize on a range of knowledge bases.”

The ESC project will provide for the needed space of the proper configuration and types to afford acceleration of convergent science—a need that can be achieved only through material means. It also will enable a cascade of moves to enable location of synergistic capabilities in optimal spaces without losing those capabilities for extended time periods and negatively impacting research. The ESC project also further advances the PNNL campus strategy to modernize and increase federal ownership of the Laboratory and seeks to directly impact PNNL’s core capabilities by creating space that enables research in support of BES, BER, and ASCR programs.

^a Other Project Costs (OPC) are funded through laboratory overhead.

^b <https://www.aplu.org/projects-and-initiatives/research-science-and-technology/hibar/resources/MITwhitepaper.pdf>

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	Threshold	Objective
Multi-story Laboratory Building	110,000 gross square feet (gsf)	145,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs ^a
Total Estimated Cost (TEC)			
Design			
FY 2018	9,000	9,000	489
FY 2019	—	—	8,511
Total, Design	9,000	9,000	9,000
Construction			
FY 2018	11,000	11,000	—
FY 2019	24,000	24,000	20,000
FY 2020	23,000	23,000	20,000
FY 2021	23,000	23,000	20,000
Outyears	—	—	21,000
Total, Construction	81,000	81,000	81,000
Total Estimated Cost (TEC)			
FY 2018	20,000	20,000	489
FY 2019	24,000	24,000	28,511
FY 2020	23,000	23,000	20,000
FY 2021	23,000	23,000	20,000
Outyears	—	—	21,000
Total, TEC	90,000	90,000	90,000
Other Project Cost (OPC)			
FY 2017	839	839	839
FY 2018	397	397	397
Outyears	1,764	1,764	1,764
Total, OPC^b	3,000	3,000	3,000

^a Costs through 2019 reflect actual Costs; costs for FY 2020 and the outyears are estimates.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs^a
Total Project Cost (TPC)			
FY 2017	839	839	839
FY 2018	20,397	20,397	886
FY 2019	24,000	24,000	28,511
FY 2020	23,000	23,000	20,000
FY 2021	23,000	23,000	20,000
Outyears	1,764	1,764	22,764
Total, TPC	93,000	93,000	93,000

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	7,500	7,500	7,500
Contingency	1,500	1,500	1,500
Total, Design	9,000	9,000	9,000
Construction			
Construction	70,000	70,000	70,000
Contingency	11,000	11,000	11,000
Total, Construction	81,000	81,000	81,000
Total, TEC	90,000	90,000	90,000
<i>Contingency, TEC</i>	<i>12,500</i>	<i>12,500</i>	<i>12,500</i>
Other Project Cost (OPC)			
OPC except D&D			
OPC except D&D	1,650	1,650	1,650
Conceptual Planning	100	100	100
Conceptual Design	1,000	1,000	1,000
Contingency	250	250	250
Total, OPC^b	3,000	3,000	3,000
<i>Contingency, OPC</i>	<i>250</i>	<i>250</i>	<i>250</i>
Total Project Cost	93,000	93,000	93,000
<i>Total, Contingency (TEC+OPC)</i>	<i>12,750</i>	<i>12,750</i>	<i>12,750</i>

^a Costs through 2019 reflect actual Costs; costs for FY 2020 and the outyears are estimates.

^b Other Project Costs (OPC) are funded through laboratory overhead.

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2018	TEC	20,000	TBD	TBD	TBD	TBD	90,000
	OPC ^a	—	—	—	—	—	3,000
	TPC	20,000	TBD	TBD	TBD	TBD	93,000
FY 2019	TEC	1,000	4,000	8,194	22,209	54,597	90,000
	OPC ^a	2,600	—	—	—	400	3,000
	TPC	3,600	4,000	8,194	22,209	54,997	93,000
FY 2020	TEC	20,000	24,000	9,000	20,000	17,000	90,000
	OPC ^a	1,639	—	—	—	1,361	3,000
	TPC	21,639	24,000	9,000	20,000	18,361	93,000
FY 2021	TEC	20,000	24,000	23,000	23,000	—	90,000
	OPC ^a	1,236	—	—	—	1,764	3,000
	TPC	21,236	24,000	23,000	23,000	1,764	93,000

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY 2024
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2074

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	480	480	23,989	23,989
Utilities	547	547	27,370	27,370
Maintenance and Repair	1,222	1,222	61,121	61,121
Total, Operations and Maintenance	2,249	2,249	112,480	112,480

^a Other Project Costs (OPC) are funded through laboratory overhead.

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Pacific Northwest National Laboratory.....	110,000 to 145,000
Area of D&D in this project at Pacific Northwest National Laboratory.....	None
Area at Pacific Northwest National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None ^a
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	None
Total area eliminated	None

8. Acquisition Approach

The PNNL Management and Operating (M&O) contractor, Battelle Memorial Institute, will perform the acquisition for this project, overseen by the Pacific Northwest Site Office. The M&O contractor considered various acquisition approaches and project delivery methods prior to achieving CD-1 and will be responsible for awarding and administering all subcontracts related to this project. The M&O contractor’s annual performance evaluation and measurement plan will include project performance metrics on which they will be evaluated.

^a With the implementation of OMB’s Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

**17-SC-71, Integrated Engineering Research Center
Fermi National Accelerator Laboratory (FNAL)
Project is for Design and Construction**

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

Summary

The FY 2021 Request for the Integrated Engineering Research Center (IERC) project is \$12,000,000. The Total Estimated Cost (TEC) range for this project is \$73,000,000 to \$98,000,000. The Total Project Cost (TPC) range for this project is \$74,000,000 to \$99,000,000. The preliminary TPC estimate for this project is \$86,000,000.

This project will construct new space to accommodate increased collaboration and interactions among Fermi National Accelerator Laboratory (FNAL) staff. The project is intended to close an infrastructure capability gap which will impede the establishment of an international neutrino campus as recommended by the Particle Physics Project Prioritization Panel (P5).

Significant Changes

This project was initiated in FY 2017. The most recent DOE Order 413.3B Critical Decision (CD) is CD-3A, Long Lead Procurement, which was approved on July 16, 2019. FY 2021 funds will support the continuation of construction and associated activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than \$50,000,000 and equal to or less than \$100,000,000) has been assigned to this project.

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 2017	7/17/15	N/A	1Q FY 2017	3Q FY 2018 ^a	N/A	3Q FY 2019 ^a	N/A	4Q FY 2023 ^a
FY 2018	7/17/15	N/A	4/18/17	3Q FY 2019 ^a	N/A	3Q FY 2020 ^a	N/A	4Q FY 2024 ^a
FY 2019	7/17/15	3Q FY 2018	4/18/17	3Q FY 2019 ^a	3Q FY 2019	3Q FY 2020 ^a	N/A	4Q FY 2024 ^a
FY 2020	7/17/15	4/18/17	4/18/17	3Q FY 2019 ^a	3Q FY 2019	3Q FY 2019 ^a	N/A	2Q FY 2024 ^a
FY 2021	7/17/15	4/18/17	4/18/17	4Q FY 2020 ^a	2Q FY 2020	4Q FY 2020 ^a	N/A	3Q FY 2024 ^a

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

^a This project is pre-CD-2; therefore, schedule estimates are preliminary.

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2017	N/A	N/A
FY 2018	N/A	N/A
FY 2019	3Q FY 2019	N/A
FY 2020	4/18/18	N/A
FY 2021	4/18/18	7/16/19

CD-3A – Approve Long-Lead Procurements, Original Scope

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC ^a , Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	10,000	75,000 ^b	85,000 ^b	2,000	N/A	2,000	87,000 ^b
FY 2018	10,000	75,000 ^b	85,000 ^b	1,000	N/A	1,000	86,000 ^b
FY 2019	7,000	78,000 ^b	85,000 ^b	1,000	N/A	1,000	86,000 ^b
FY 2020	7,000	78,000	85,000 ^b	1,000	N/A	1,000	86,000 ^b
FY 2021	7,000	78,000	85,000 ^b	1,000	N/A	1,000	86,000 ^b

2. Project Scope and Justification

Scope

The IERC project will construct an approximately 67,000 gross square feet (gsf) to 134,000 gsf building to accommodate increased collaboration and interactions among staff at Fermi National Accelerator Laboratory (FNAL), who will in turn be working with scientific collaborators and international partners in the design, construction, and operation of physics experiments.

Justification

In May 2014, the Particle Physics Project Prioritization Panel (P5) issued a report that included recommendations to “...develop a coherent short- and long-baseline neutrino program hosted at Fermilab,” and to “reformulate the long-baseline neutrino program as an internationally designed, coordinated, and funded program with [Fermi National Accelerator Laboratory, FNAL or Fermilab] as host.” SC and the High Energy Physics (HEP) program accepted the recommendations in the P5 report and are committed to implementing a successful program based on this new vision.

Implementing these recommendations will require significantly increased collaboration and interactions among FNAL staff, who will in turn be working with scientific collaborators and international partners in the design, construction, and operation of physics experiments. Currently, these staff and their associated manufacturing, assembly, engineering, and technical facilities are scattered among three parts of the campus – the Silicon Detector Complex, the Village, and Wilson Hall. As a result, they are unable to efficiently collaborate on ongoing and planned projects in support of the laboratory’s mission.

Collocation of these staff will improve collaboration because it will increase interactions among the various groups and reduce down-time spent traveling across the site. From an infrastructure standpoint, however, FNAL currently lacks sufficient space to do this. Continuing the previous example, groups from the three Divisions noted above total approximately 300 staff occupying more than 170,000 square feet of laboratories, technical areas, and offices in 15 buildings and trailers. In addition, many of these spaces are inadequate to accommodate current and planned scientific

^a Other project costs (OPC) are funded through laboratory overhead.

^b This project has not received CD-2 approval; therefore, funding estimates are preliminary.

programs because they are obsolete (e.g., leaking roofs, inadequate HVAC systems) and do not support the configuration or specification needs of current and future technical programs. The IERC will provide FNAL with a collaborative, multi-divisional, and interdisciplinary research center, which will close existing capability and infrastructure gaps by reducing the overall footprint of outdated facilities, and collocating engineering and associated research staff in a new or renovated facility near the central campus. This approach will complement the ongoing and planned renovations of Wilson Hall by establishing the main campus as the anchor point of the site. It will improve operational efficiency and collaboration because groups working on key projects would be in close proximity to one another. Such a facility will provide technical and engineering staff the necessary environment for interdisciplinary collaboration necessary to establish an international neutrino program and support other HEP science opportunities described in the P5 report.

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 Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Multistory Laboratory/Office Building	67,000 gsf	134,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs ^a
Total Estimated Cost (TEC)			
Design			
FY 2017	2,500	2,500	38
FY 2018	4,500	4,500	1,552
FY 2019	—	—	3,190
FY 2020	—	—	2,220
Total, Design	7,000	7,000	7,000
Construction			
FY 2018	15,500	15,500	—
FY 2019	20,000	20,000	4,810
FY 2020	22,000	22,000	20,190
FY 2021	12,000	12,000	25,000
Outyears	8,500	8,500	28,000
Total, Construction	78,000	78,000	78,000

^a Costs through 2019 reflect actual Costs; costs for FY 2020 and the outyears are estimates.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs^a
Total Estimated Cost (TEC)			
FY 2017	2,500	2,500	38
FY 2018	20,000	20,000	1,552
FY 2019	20,000	20,000	8,000
FY 2020	22,000	22,000	22,410
FY 2021	12,000	12,000	25,000
Outyears	8,500	8,500	28,000
Total, TEC^a	85,000	85,000	85,000
Other Project Cost (OPC)^b			
FY 2015	120	120	120
FY 2016	510	510	510
FY 2017	300	300	300
Outyears	70	70	70
Total, OPC	1,000	1,000	1,000
Total Project Cost (TPC)			
FY 2015	120	120	120
FY 2016	510	510	510
FY 2017	2,800	2,800	338
FY 2018	20,000	20,000	1,552
FY 2019	20,000	20,000	8,000
FY 2020	22,000	22,000	22,410
FY 2021	12,000	12,000	25,000
Outyears	8,570	8,570	28,070
Total, TPC^b	86,000	86,000	86,000

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	6,000	6,000	N/A
Contingency	1,000	1,000	N/A
Total, Design	7,000	7,000	N/A
Construction			
Construction	63,000	63,000	N/A
Contingency	15,000	15,000	N/A
Total, Construction	78,000	78,000	N/A
Total, TEC^a	85,000	85,000	N/A
<i>Contingency, TEC</i>	<i>16,000</i>	<i>16,000</i>	<i>N/A</i>
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	250	250	N/A
Conceptual Design	530	530	N/A
Other OPC Costs	150	150	N/A
Contingency	70	70	N/A
Total, OPC^b	1,000	1,000	N/A
<i>Contingency, OPC</i>	<i>70</i>	<i>70</i>	<i>N/A</i>
Total Project Cost	86,000	86,000	N/A
<i>Total, Contingency (TEC+OPC)</i>	<i>16,070</i>	<i>16,070</i>	<i>N/A</i>

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2017	TEC	2,500	TBD	TBD	—	TBD	85,000 ^a
	OPC ^b	500	TBD	TBD	—	TBD	2,000
	TPC	5,000	TBD	TBD	—	TBD	87,000 ^a
FY 2018	TEC	4,000	TBD	TBD	—	TBD	85,000 ^a
	OPC ^b	1,000	—	—	—	—	1,000
	TPC	5,000	TBD	TBD	—	TBD	86,000 ^a
FY 2019	TEC	4,000	5,000	20,000	28,096	27,904	85,000 ^a
	OPC ^b	930	—	—	—	70	1,000
	TPC	4,930	5,000	20,000	28,096	27,974	86,000 ^a

^a This project has not received CD-2 approval; therefore, funding estimates are preliminary.

^b Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	FY 2021	Outyears	Total
FY 2020	TEC	22,500	20,000	10,000	—	32,500	85,000 ^a
	OPC ^b	930	—	—	—	70	1,000
	TPC	23,430	20,000	10,000	—	32,570	86,000 ^a
FY 2021	TEC	22,500	20,000	22,000	12,000	8,500	85,000 ^a
	OPC ^b	930	—	—	—	70	1,000
	TPC	23,430	20,000	22,000	12,000	8,570	86,000 ^a

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	3Q FY 2024
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	3Q FY 2074

Related Funding Requirements (dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	508	508	25,428	25,428
Utilities	94	94	4,670	4,670
Maintenance and Repair	1,525	1,525	76,285	76,285
Total, Operations and Maintenance	2,127	2,127	106,383	106,383

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Fermi National Accelerator Laboratory.....	67,000 - 134,000
Area of D&D in this project at Fermi National Accelerator Laboratory.....	None
Area at Fermi National Accelerator Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	55,200
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None ^a
Total area eliminated	55,200

^a With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

8. Acquisition Approach

The FNAL Management and Operating (M&O) contractor, Fermi Research Alliance, LLC will perform the acquisition for this project, overseen by the Fermi Site Office. The M&O contractor evaluated various acquisition approaches and project delivery methods prior to achieving CD-1 and selected a Construction Manager/General Contractor (CM/GC) project delivery with best value procurement approach as the overall best delivery method with the lowest risk to DOE. The M&O contractor is responsible for awarding and administering all subcontracts related to this project. The annual performance evaluation and measurement plan includes project performance metrics on which they are evaluated.