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 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.

SC manages an infrastructure portfolio worth nearly $22 billion, which is composed of 13 sites with nearly 23 million gross square feet (gsf) in 1,570 government owned buildings. SC assets at the 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. The average age of SC's buildings is over 42 years, and nearly half are rated substandard or inadequate to meet mission needs. In addition, utility systems across several laboratories are suffering from failures and frequent, often costly, repairs. While there has been significant federal stewardship of research, user and research support facilities, core infrastructure and utility systems maintenance has lagged behind, resulting in many of these critical assets falling into disrepair. Collectively, these issues impact scientific progress and impair mission accomplishment. The SLI program has taken the lead over the last several years in working with laboratories to ensure appropriate stewardship of general-purpose infrastructure and supporting utility systems.

In FY 2018, SC invested over $550 million in needed maintenance, repair, and upgrades of general purpose infrastructure. These investment activities were from a variety of funding sources, including Federal appropriations for line-item construction projects and general plant projects (GPPs), as well as overhead-funded investments in institutional GPP (IGPP) work and routine maintenance and repair. The SLI program provides two important pieces of this overall strategy—line-item construction projects and a suite of infrastructure support investments that focus on laboratory core infrastructure and operations.

SC laboratories conduct rigorous and consistent analyses of the condition, utilization, and functionality of the facilities and infrastructure that are the most critical to mission accomplishment. SC works with each of its laboratories to use these assessments in developing comprehensive Campus Strategies, which are integrated into the SC Annual Laboratory Planning process. Each laboratory's Campus Strategy identifies activities and infrastructure investments (e.g., Line-Item Construction, GPPs) required to achieve the core capabilities and scientific vision for the laboratory. SC leadership uses these Campus Strategies to establish the corporate facilities and infrastructure needs and priorities, which, combined with complex-wide infrastructure analyses, form the basis for SLI Budget Requests.

Highlights of the FY 2020 Request

The SLI program request for $163,600,000 continues to focus on improving infrastructure across the SC national laboratory complex. The FY 2020 Request includes funding for five new construction starts: 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 Craft Resources Support Facility at Oak Ridge National Laboratory (ORNL), and the Large Scale Collaboration Center at SLAC National Accelerator Laboratory (SLAC).

The Request supports six ongoing construction projects: the Integrated Engineering Research Center at Fermi National Accelerator Laboratory (FNAL), the Energy Sciences Capability project at Pacific Northwest National Laboratory (PNNL), the Science User Support Center at BNL, the Electrical Capacity and Distribution Capability at Argonne National Laboratory (ANL), the Translational Research Capability project at ORNL, and the Biological and Environmental Program Integration Center (BioEPIC) at LBNL. 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 mission potential.

The FY 2020 Request includes funding for general purpose infrastructure projects that will address inadequate core infrastructure and utility needs across SC laboratories and facilities. SLI maintains an active list of laboratory critical core

infrastructure needs. Currently, the highest priority items include critical utility upgrades at ANL and safety and facility improvements at Ames Laboratory. Priorities are evaluated annually and will be reassessed upon entry into the FY 2020 execution year.

Funding is also requested in FY 2020 for the acquisition of previously leased real property on the PNNL campus. This funding addresses a long-standing complexity in consideration of laboratory recompetition while ensuring the continuity of PNNL activities.

Lastly, the Request continues funding a project to de-inventory, remove, and transfer nuclear material at Building 350, formerly the site of the New Brunswick Laboratory (NBL) on the ANL campus. In FY 2020, the NBL Special Nuclear Material (SNM) Certified Reference Material (CRM) program management mission is proposed for transfer from SC to the National Nuclear Security Administration (NNSA) as functions are better aligned with the Naval Reactors, Defense Nuclear Nonproliferation, and Defense program missions of NNSA than the core SC program missions.

Science Laboratories Infrastructure
Funding

(dollars in thousands)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted
Infrastructure Support	**104,442**	**79,690**	**45,200**	**-34,490**
Construction				
20-SC-71, Critical Utilities Rehabilitation Project, BNL	—	—	12,000	+12,000
20-SC-72, Seismic and Safety Modernization, LBNL	—	—	5,000	+5,000
20-SC-73, CEBAF Renovation and Expansion, TJNAF	—	—	2,000	+2,000
20-SC-74, Craft Resources Support Facility, ORNL	—	—	20,000	+20,000
20-SC-75, Large Scale Collaboration Center, SLAC	—	—	3,000	+3,000
19-SC-71, Science User Support Center, BNL	—	7,000	6,400	-600
19-SC-72, Electrical Capacity and Distribution Capability, ANL	—	30,000	30,000	—
19-SC-73, Translational Research Capability, ORNL	—	25,000	15,000	-10,000
19-SC-74, BioEPIC, LBNL	—	5,000	6,000	+1,000
18-SC-71, Energy Sciences Capability, PNNL	20,000	24,000	9,000	-15,000
17-SC-71, Integrated Engineering Research Center, FNAL	20,000	20,000	10,000	-10,000
17-SC-73, Core Facility Revitalization, BNL	30,000	42,200	—	-42,200
15-SC-76, Materials Design Laboratory, ANL	44,500	—	—	—
15-SC-78, Integrative Genomics Building, LBNL	38,350	—	—	—
Total, Construction	**152,850**	**153,200**	**118,400**	**-34,800**
Total, Science Laboratories Infrastructure	**257,292**	**232,890**	**163,600**	**-69,290**

Science Laboratories Infrastructure
Explanation of Major Changes

(dollars in thousands)

	FY 2020 Request vs FY 2019 Enacted
Infrastructure Support	**-34,490**
The Request continues funding to support Payment in Lieu of Taxes (PILT), nuclear facilities at ORNL, and landlord responsibilities at the Oak Ridge Reservation. Funding continues to support de-inventory, removal, and transfer of nuclear material at Building 350, formerly the site of NBL on the ANL campus. Funding for critical core infrastructure across the SC complex decreases in FY 2020. The FY 2020 Request proposes the transfer of Oak Ridge PILT requirements from the Oak Ridge Landlord activity to the PILT activity.	
Construction	**-34,800**
Funding supports six ongoing line-item projects at FNAL, PNNL, BNL, ANL, ORNL, and LBNL. Also, funding supports the initiation of five new line-item projects at BNL, LBNL, TJNAF, SLAC, and ORNL. Funding decreases in FY 2020 as the Core Facility Revitalization project at BNL received final funding in FY 2019.	
Total, Science Laboratories Infrastructure	**-69,290**

Program Accomplishments
Since FY 2006, the SLI program has invested over $1.2 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 13 line-item projects while garnering nine 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 900,000 gsf of new space and modernized nearly 400,000 gsf of existing space. As a result, an estimated 2,300 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 $110 million in laboratory core infrastructure improvements including over $70 million in electrical and utility improvements and over $40 million in facility improvements. Examples of recent SLI investments in core infrastructure include renovating post-World War II era laboratory and support space 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 programs. Lastly, at SLAC, SLI funded the replacement of the low conductivity water cooling system serving the Stanford Synchrotron Radiation Light Source and the Linac Coherent Light Source.

Removal of Hazard Category 3 Materials from the former New Brunswick Laboratory (NBL). As of April 2017, the SLI program successfully removed nuclear material from the former NBL on the ANL site to bring the building to the state of a Radiological Facility – i.e., below Hazard Category 3. In FY 2018, the project team disposed of approximately 5,700 items, including about 1,170 higher-risk uranium metal items. The SLI program continues to remove the remaining nuclear materials so the building can eventually be renovated and repurposed.

The SLI funded *Utilities Improvement Project at FNAL* upgraded industrial cooling water and high voltage electrical systems that were well beyond useful life and experienced frequent malfunctions and unscheduled repairs. This project was completed in FY 2018 and has provided the laboratory with high capacity, efficient, and dependable systems directly supporting its mission of world leadership in particle physics.

The SLI funded *Utilities Infrastructure Modernization project at TJNAF* upgraded cryogenic, electrical distribution, cooling water, and communication systems that were experiencing frequent failures and were no longer adequate to support growth and SC mission requirements. This project was completed in FY 2018 and has provided the laboratory with the utilities necessary to pursue scientific excellence and preeminence in the study of nuclear building blocks, the underlying quark-gluon structure of the nucleus, and tests to verify predictions of the Standard Model.

The SLI funded *Infrastructure and Operational Improvements project at PPPL* addressed several inadequate facilities at PPPL that were impeding progress towards achieving research goals as well as hindering the attraction and retention of talented staff. The project 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 will be 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.

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 facilities and utilities are upgraded when they approach end-of-life, systems are improved to increase reliability and performance, and excess space is removed so that it no longer requires operation and maintenance funding. Without this type of investment, SC laboratories would not be able to keep up with the pace of needed upgrades and repairs. Activities include core infrastructure upgrades at various laboratories, general infrastructure support, de-inventory of nuclear material in Building 350 (formerly NBL) at ANL, and support for the nuclear facilities at ORNL.

This subprogram also funds 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 validate 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. Currently, the highest priority items include critical utility upgrades at ANL and safety and facility improvements at AMES. Priorities are evaluated annually and will be reassessed upon entry into the FY 2020 execution year.

This activity also supports operations and maintenance, de-inventory, removal, and transfer of nuclear material in the former NBL building on the site of ANL. In FY 2020, the NBL Program Office CRM functions, formerly operated out of ANL Building 350, is proposed for transfer to NNSA as those functions are better aligned with the Naval Reactors, Defense Nuclear Nonproliferation, and Defense program missions of NNSA than the core SC program missions.

In FY 2020, funding is requested for the acquisition of real property (land and facilities) from Battelle Memorial Institute (BMI) that is currently in use and already part of the Pacific Northwest National Laboratory (PNNL) campus. These parcels include facilities involved in research (e.g., the Atmospheric Radiation Measurement Research Facility) as well as basic operations (e.g., the site shipping and receiving facility and office space), as well as room for expansion and collaboration in proximity to existing federal facilities. This effort addresses a long standing complexity in the consideration of laboratory recompetition, while ensuring the continuity of PNNL activities. The construction of replacement facilities for those to be acquired from BMI land was considered but would be significantly more costly than the proposed acquisition.

Nuclear Operations

To support critical DOE nuclear operations, this Request includes funding to manage ORNL's nuclear facilities (i.e., Buildings 7920, 7930, 3525, and 3025E) to current expectations, in accordance with federal regulations and DOE Directives. This funding supports critical nuclear complex equipment and infrastructure to support compliance with safety standards.

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; support and improvement of environmental protection, safety, and health; and PILT to Oak Ridge communities.

In FY 2020, SLI proposes the transfer of Oak Ridge PILT requirements from the Oak Ridge Landlord activity to the Payments in Lieu of Taxes activity.

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 the ANL and BNL 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.

In FY 2020, SLI proposes to include funding for Oak Ridge PILT requirements within this activity. Funding for Oak Ridge PILT has previously been provided under the Oak Ridge Landlord activity. This action consolidates all PILT funding.

Activities and Explanation of Changes

FY 2019 Enacted		FY 2020 Request	Explanation of Changes FY 2020 Request vs FY 2019 Enacted
Infrastructure Support	**$79,690,000**	**$45,200,000**	**-$34,490,000**
Facilities and Infrastructure	$45,543,000	$25,050,000	-$20,493,000
The FY 2019 Enacted budget continues to support de-inventory and removal of nuclear material at the former NBL Building at ANL, and critical core infrastructure at SC laboratories, ORISE, and OSTI.		The FY 2020 Request will continue to support de-inventory and removal of nuclear material at the former NBL Building at ANL, and the highest priority critical core infrastructure needs. In addition, funding is requested for the acquisition of real property at PNNL.	Funding decreases for de-inventory of nuclear materials activities at the NBL building as the project nears completion. Funding to address aging core infrastructure across the SC laboratory complex also decreases in FY 2020 to ensure ongoing infrastructure projects continue to make progress towards completion.
Nuclear Operations	$26,000,000	$10,000,000	-$16,000,000
The FY 2019 Enacted budget continues to support critical nuclear operations and provides funding to manage ORNL's nuclear facilities.		The FY 2020 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	$6,434,000	$5,610,000	-$824,000
The FY 2019 Enacted budget provides funding to support landlord responsibilities across the Oak Ridge Reservation. Activities include maintenance of roads, grounds, and other infrastructure; support and improvement of environmental protection, safety, and health; and PILT to Oak Ridge communities.		The FY 2020 Request will provide funding to support 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 decreases to reflect the transfer of OR PILT requirements to the Payments in Lieu of Taxes activity.
Payment in Lieu of Taxes	$1,713,000	$4,540,000	+2,827,000
The FY 2019 Enacted budget provides funding for PILT payments to communities around ANL and BNL.		The FY 2020 Request will provide funding for PILT payments to communities around ANL and BNL. In addition, the Request proposes the transfer of OR PILT payments to Oak Ridge communities from the Oak Ridge Landlord activity to the Payment in Lieu of Taxes activity.	Funding increases to support the transfer of OR PILT payments to this activity.

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 2020 Request includes funding for:

Five new 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; and,
- Large Scale Collaboration Center at SLAC.

Six ongoing line-item construction projects:
- Science User Support Center at BNL;
- Electrical Capacity and Distribution Capability project at ANL;
- 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.

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 support 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 assure reliability. Deteriorated and leaking steam systems along Cornell Avenue will be replaced to assure 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 fourth quarter of FY 2019. 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 $95,000,000. The preliminary TPC range for this project is $70,800,000 to $95,800,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $85,000,000 and most likely TPC for this project is estimated at $85,800,000.

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 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-0, *Approve Mission Need,* approved on September 6, 2018. The preliminary estimate for CD-1*, Approve Alternative Selection and Cost Range*, is anticipated in the fourth quarter of

FY 2019. 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 most likely TEC for this project is estimated at $95,400,000 and most likely TPC for this project is estimated at $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. 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 (double the energy with simultaneous delivery to four experimental halls) is creating more and larger collaborations, resulting in more visiting scientists to the Lab and need for space to accommodate their work.

This project will renovate 67,000 to 80,000 gsf of existing space and provide 22,000 to 92,000 gsf of new high performing and sustainable space. Upon completion, staff from the Applied Research Center (ARC) and Service Support Center (SSC) will be relocated into the CEBAF Center, providing more efficient operations. In addition, the consolidation into the CEBAF Center will allow for costly leases to be discontinued and will reduce the cost to sustain existing buildings and infrastructure while more efficiently addressing the functional workspace needs for TJNAF staff and users. This project will also replace existing utility systems that are well past service life and experience frequent failures.

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 fourth quarter of FY 2019. 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 $75,000,000 and a preliminary TPC range of $48,900,000 to $76,900,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $66,000,000 and the most likely TPC for this project is estimated at $67,900,000.

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 fourth quarter of FY 2019. This project is pre-CD-2, therefore schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of $24,500,000 to $40,000,000 and a preliminary TPC range of $25,000,000 to $40,500,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $40,000,000 and the most likely TPC for this project is estimated at $40,500,000.

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 is fully occupied or oversubscribed and do not support 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-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 fourth quarter of FY 2019. This project is pre-CD-2; therefore schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of $32,000,000 to $60,000,000 and a preliminary TPC range of $33,000,000 to $61,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $60,000,000 and the most likely TPC for this project is estimated at $61,000,000.

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 $71,000,000 to $95,000,000. 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 most likely TEC for this project is estimated at $85,000,000 and the most likely TPC for this project is estimated at $86,000,000.

Electrical Capacity and Distribution Capability, ANL

The Electrical Capacity and Distribution Capability project will improve and expand critical electrical distribution systems to support the electrical capacity growth needed to support the Advanced Scientific Computing Research investments in an exascale-capable supercomputer, as part of the DOE Exascale Computing Initiative. Elements of ANL's high voltage electrical distribution systems are rated in poor condition due to age, limiting the ability to support the electricity requirements of new and expanding facilities and scientific programs. Much of the main electrical supply infrastructure was constructed in the 1960's and is now beyond its useful life.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, *Approve Mission Need,* approved on September 11, 2017. The preliminary estimate for CD-1*, Approve Alternative Selection and Cost Range*, is anticipated in the second quarter of FY 2019. This project is pre-CD-2, therefore schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of $52,000,000 to $96,000,000 and a preliminary TPC range of $53,000,000 to $97,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $60,000,000 and the most likely TPC for this project is estimated at $61,000,000.

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-1, *Approve Alternative Selection and Cost Range,* approved on November 2, 2018. The preliminary estimate for CD-2*, Approve Performance Baseline*, 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 $80,000,000 to $97,000,000 and a preliminary TPC range of $81,500,000 to $98,500,000. These

cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $93,500,000 and most likely TPC for this project is estimated at $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, away from the main laboratory, while others 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-0, *Approve Mission Need,* approved on March 13, 2018. The preliminary estimate for CD-1*, Approve Alternative Selection and Cost Range*, is anticipated in the second quarter of FY 2019. This project is pre-CD-2, therefore schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of $90,000,000 to $140,000,000 and a preliminary TPC range of $92,200,000 to $142,200,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $140,000,000 and the most likely TPC for this project is estimated at $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 2025. 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-1, *Approve Alternative Selection and Cost Range*, which was approved on April 18, 2017. The preliminary estimate for CD-2/3, *Approve Project Baseline and Approve Start of Construction Activities,* is anticipated in the third quarter of FY 2019. 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 most likely TEC for this project is estimated at $85,000,000 and most likely TPC for this project is estimated at $86,000,000.

Activities and Explanation of Changes

FY 2019 Enacted		FY 2020 Request	Explanation of Changes FY 2020 Request vs FY 2019 Enacted
Construction	**$153,200,000**	**$118,400,000**	**-$34,800,000**
20-SC-71, Critical Utilities Rehabilitation Project, BNL	$—	$12,000,000	+$12,000,000
No funding was requested in FY 2019.		Funding will support Project Engineering and Design (PED) and construction activities.	Funding supports PED and construction activities.
20-SC-72, Seismic and Safety Modernization, LBNL	$—	$5,000,000	+$5,000,000
No funding was requested in FY 2019.		Funding will support PED activities.	Funding supports PED activities.
20-SC-73, CEBAF Renovation and Expansion, TJNAF	$—	$2,000,000	+$2,000,000
No funding was requested in FY 2019.		Funding will support PED activities.	Funding supports PED activities.
20-SC-74, Craft Resources Support Facility, ORNL	$—	$20,000,000	+$20,000,000
No funding was requested in FY 2019.		Funding will support PED and construction activities.	Funding supports PED and construction activities.
20-SC-75, Large Scale Collaboration Center, SLAC	$—	$3,000,000	+$3,000,000
No funding was requested in FY 2019.		Funding will support PED activities.	Funding supports PED activities.
19-SC-71, Science User Support Center, BNL	$7,000,000	$6,400,000	-$600,000
Funding supports PED activities.		Funding will support the completion of PED activities and start of construction activities.	Funding supports PED and construction activities.
19-SC-72, Electrical Capacity and Distribution Capability, ANL	$30,000,000	$30,000,000	$—
Funding supports PED and construction activities.		Funding will support the completion of construction activities.	FY 2020 Request reflects final year of funding.

FY 2019 Enacted	FY 2020 Request	Explanation of Changes FY 2020 Request vs FY 2019 Enacted
19-SC-73, Translational Research Capability, ORNL $25,000,000	$15,000,000	-$10,000,000
Funding supports PED and construction activities.	Funding will support construction activities.	Funding supports construction activities.
19-SC-74, BioEPIC, LBNL $5,000,000	$6,000,000	+$1,000,000
Funding supports PED activities.	Funding will support PED activities.	Funding supports PED activities.
18-SC-71, Energy Sciences Capability, PNNL $24,000,000	$9,000,000	-$15,000,000
Funding supports construction activities.	Funding will support construction activities.	Funding supports construction activities.
17-SC-71, Integrated Engineering Research Center, FNAL $20,000,000	$10,000,000	-$10,000,000
Funding supports construction activities.	Funding will support construction activities.	Funding supports construction activities.
17-SC-73, Core Facility Revitalization, BNL $42,200,000	$—	-$42,200,000
Funding supports construction activities.	No funding is requested in FY 2020.	Project received final funding in FY 2019.

Science Laboratories Infrastructure
Capital Summary

(dollars in thousands)

	Total	Prior Years	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted
Capital Operating Expenses Summary						
Minor Construction Activities						
General Plant Projects (GPP)	N/A	N/A	59,492	13,188	5,050	-8,138
Total, Capital Operating Expenses	**N/A**	**N/A**	**59,492**	**13,188**	**5,050**	**-8,138**

Minor Construction Activities

(dollars in thousands)

	Total	Prior Years	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted
General Plant Projects (GPP)						
Greater than or equal to $5M and less than $20M						
Upgrade Hot Cells and Labs B801 at BNL	N/A	N/A	8,500	—	—	—
Revitalize Biology Labs at BNL	N/A	N/A	5,000	—	—	—
Supply Water CMLC Piping Replacement at LBNL	N/A	N/A	9,500	—	—	—
Upgrade Cryogenics Infrastructure Phase 2 at TJNAF	N/A	N/A	9,900	—	—	—
Storm Drain Repairs at LBNL	N/A	N/A	7,000	—	—	—
Low Conductivity Water Cooling System at SLAC	N/A	N/A	8,800	—	—	—
Cooling Water Tower System at SLAC	N/A	N/A	—	9,400	—	-9,400
Total, GPPs (greater than or equal to $5M and less than $20M)	N/A	N/A	48,700	9,400	—	-9,400
Total, GPPs less than $5M[a]	N/A	N/A	10,792	3,788	5,050	+1,262
Total, GPP	**N/A**	**N/A**	**59,492**	**13,188**	**5,050**	**-8,138**
Total, Minor Construction Activities	**N/A**	**N/A**	**59,492**	**13,188**	**5,050**	**-8,138**

[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.

Science Laboratories Infrastructure
Construction Projects Summary

(dollars in thousands)

	Total	Prior Years	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted
20-SC-71, Critical Utilities Rehabilitation Project, BNL						
TEC	85,000[a]	—	—	—	12,000	+12,000
OPC[b]	800	—	—	800	—	-800
TPC	**85,800[a]**	**—**	**—**	**800**	**12,000**	**+11,200**
20-SC-72, Seismic and Safety Modernization, LBNL						
TEC	95,400[a]	—	—	—	5,000	+5,000
OPC[b]	2,200	—	—	1,500	—	-1,500
TPC	**97,600[a]**	**—**	**—**	**1,500**	**5,000**	**+3,500**
20-SC-73, CEBAF Renovation and Expansion, TJNAF						
TEC	66,000[a]	—	—	—	2,000	+2,000
OPC[b]	1,900	—	20	1,465	—	-1,465
TPC	**67,900[a]**	**—**	**20**	**1,465**	**2,000**	**+535**
20-SC-74, Craft Resources Support Facility, ORNL						
TEC	40,000[a]	—	—	—	20,000	+20,000
OPC[b]	500	—	—	400	—	-400
TPC	**40,500[a]**	**—**	**—**	**400**	**20,000**	**+19,600**
20-SC-75, Large Scale Collaboration Center, SLAC						
TEC	60,000[a]	—	—	—	3,000	+3,000
OPC[b]	1,000	—	—	700	—	-700
TPC	**61,000[a]**	**—**	**—**	**700**	**3,000**	**+2,300**
19-SC-71, Science User Support Center, BNL						
TEC	85,000[a]	—	—	7,000	6,400	-600
OPC[b]	1,200	700	300	200	—	-200
TPC	**86,200[a]**	**700**	**300**	**7,200**	**6,400**	**-800**

[a] This project has not received CD-2 approval; therefore, preliminary cost estimates are shown for TEC and TPC.
[b] Other Project Costs (OPC) are funded through laboratory overhead.

(dollars in thousands)

	Total	Prior Years	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted
19-SC-72, Electrical Capacity and Distribution Capability, ANL						
TEC	60,000[a]	—	—	30,000	30,000	—
OPC[b]	1,000	—	1,000	—	—	—
TPC	**61,000[a]**	**—**	**1,000**	**30,000**	**30,000**	**—**
19-SC-73, Translational Research Capability, ORNL						
TEC	93,500[a]	—	—	25,000	15,000	-10,000
OPC[b]	1,500	190	1,000	—	—	—
TPC	**95,000[a]**	**190**	**1,000**	**25,000**	**15,000**	**-10,000**
19-SC-74, BioEPIC, LBNL						
TEC	140,000[a]	—	—	5,000	6,000	+1,000
OPC[b]	2,200	—	—	1,500	—	-1,500
TPC	**142,200[a]**	**—**	**—**	**6,500**	**6,000**	**-500**
18-SC-71, Energy Sciences Capability, PNNL						
TEC	90,000	—	20,000	24,000	9,000	-15,000
OPC[b]	3,000	839	400	—	—	—
TPC	**93,000[a]**	**839**	**20,400**	**24,000**	**9,000**	**-15,000**
17-SC-71, Integrated Engineering Research Center, FNAL						
TEC	85,000[a]	2,500	20,000	20,000	10,000	-10,000
OPC[b]	1,000	930	—	—	—	—
TPC	**86,000[a]**	**3,430**	**20,000**	**20,000**	**10,000**	**-10,000**
17-SC-73, Core Facility Revitalization, BNL						
TEC	74,000[a]	1,800	30,000	42,200	—	-42,200
OPC[b]	850	850	—	—	—	—
TPC	**74,850[a]**	**2,650**	**30,000**	**42,200**	**—**	**-42,200**

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

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

(dollars in thousands)

	Total	Prior Years	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted
15-SC-76, Materials Design Laboratory, ANL						
TEC	95,000	30,910	44,500	—	—	—
OPC[a]	1,000	1,000	—	—	—	—
TPC	**96,000**	**31,910**	**44,500**	**—**	**—**	**—**
15-SC-78, Integrative Genomics Building, LBNL						
TEC	90,000	32,090	38,350	—	—	—
OPC[a]	1,500	1,500	—	—	—	—
TPC	**91,500**	**33,590**	**38,350**	**—**	**—**	**—**
Total, Construction						
TEC	N/A	N/A	152,850	153,200	118,400	-34,800
OPC[a]	N/A	N/A	2,720	6,565	—	-6,565
TPC	**N/A**	**N/A**	**155,570**	**159,765**	**118,400**	**-41,365**

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

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 2020 Request for the Critical Utilities Rehabilitation Project is $12,000,000. The current preliminary Total Estimated Cost (TEC) range for this project is $70,000,000 to $95,000,000. The preliminary Total Project Cost (TPC) range for this project is $70,800,000 to $95,800,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC for this project is estimated at $85,000,000 and preliminary TPC for this project is estimated at $85,800,000.

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 is a new start 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. FY 2020 funds will support Project Engineering and Design (PED) activities and initiate long-lead procurement activities.

A Federal Project Director with the appropriate certification level will be assigned 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 2020	7/20/2018	4Q FY 2019	4Q FY 2019[a]	4Q FY 2020[a]	4Q 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 (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 2020[a]	N/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, 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[b]	800	N/A	800	85,800[b]

2. Project Scope and Justification

Scope

The Critical Utilities Rehabilitation Project at BNL will revitalize and upgrade highest risk major utility systems across the BNL campus. 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 assure reliability. Deteriorated and leaking steam systems along Cornell Avenue will be replaced to assure 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.

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.

Key Performance Parameters (KPPs) (Preliminary)

This project has not yet received CD-1 approval; therefore the Key Performance Parameters (KPPs) are yet to be determined. The table below outlines preliminary KPPs.

Performance Measure	Threshold	Objective
Chilled Water Supply	Replacement/installation of components	TBD
Sanitary Sewer System	Replacement/installation of components	TBD
Electrical Distribution System	Replacement/installation of components	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.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	8,500	8,500	8,500
Total, Design	8,500	8,500	8,500
Construction			
FY 2020	3,500	3,500	2,000
Outyears	73,000	73,000	74,500
Total, Construction	76,500	76,500	76,500
Total Estimated Costs (TEC)			
FY 2020	12,000	12,000	10,500
Outyears	73,000	73,000	74,500
Total, TEC[a]	**85,000**	**85,000**	**85,000**
Other Project Costs (OPC)[b]			
FY 2019	800	800	800
Total, OPC	800	800	800
Total Project Costs (TPC)			
FY 2019	800	800	800
FY 2020	12,000	12,000	10,500
Outyears	73,000	73,000	74,500
Total, TPC[a]	**85,800**	**85,800**	**85,800**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	6,800	N/A	N/A
Contingency	*1,700*	*N/A*	*N/A*
Total, Design	8,500	N/A	N/A
Construction			
Construction	61,200	N/A	N/A
Contingency	*15,300*	*N/A*	*N/A*
Total, Construction	76,500	N/A	N/A
Total, TEC[a]	**85,000**	**N/A**	**N/A**
Contingency, TEC	*17,000*	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
OPC Costs	800	N/A	N/A
Contingency	—	*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
Total, OPC[a]	**800**	**N/A**	**N/A**
Contingency, OPC	—	*N/A*	*N/A*
Total Project Cost[b]	**85,800**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***17,000***	***N/A***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	Outyears	Total
FY 2020	TEC	—	12,000	73,000	85,000[b]
	OPC[a]	800	—	—	800
	TPC	800	12,000	16,000	85,800[b]

6. Related Operations and Maintenance Funding Requirements

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
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[c]
Total area eliminated	None

[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] 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. 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. Project performance metrics for BNL will be included in the M&O contractor's annual performance and evaluation measurement plan.

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 2020 Request for the Seismic and Safety Modernization project is $5,000,000. The preliminary Total Estimated Cost (TEC) range is $65,600,000 to 95,400,000 and the preliminary the Total Project Cost (TPC) range is $67,800,000 to $97,600,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC for this project is estimated at $95,400,000 and the preliminary TPC for this project is estimated at $97,600,000.

Significant Changes

This project is a new start in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on September 6, 2018. FY 2020 funds will support the 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 2020	09/06/2018	4Q FY 2019	4Q FY 2019[a]	4Q FY 2021[a]	4Q FY 2022	4Q FY 2022[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	CD-3A	CD-3B
FY 2020	4Q FY 2021	N/A	N/A

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

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 2020	10,000	85,400	95,400[a]	2,200	N/A	2,200	97,600[a]

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

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

2. Project Scope and Justification

Scope

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 and transportation capabilities that are necessary for emergency response personnel and maintain continuity of operations. The facilities that are the primary focus of this project are the Cafeteria, Health Services, and Fire House sleep quarters. The project will also address the limited space to congregate during an emergency situation.

Justification

The Office of Science (SC) utilizes the capabilities of LBNL to execute 22 of the 24 core capabilities and the mission of multiple SC program offices, specifically strong presences by the Advanced Scientific Computing Research (ASCR), Biological and Environment Research (BER), Basic Energy Sciences (BES), and High Energy Physics (HEP) 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% 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 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) (Preliminary)

This project is pre-CD-1, therefore preliminary KKPs are not yet established. At CD-2 approval, the KPPs will be baselined. 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
TBD	TBD	TBD

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	5,000	5,000	5,000
Outyears	5,000	5,000	5,000

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total, Design	10,000	10,000	10,000
Construction			
Outyears	85,400	85,400	85,400
Total, Construction	85,400	85,400	85,400
Total Estimated Costs (TEC)			
FY 2020	5,000	5,000	5,000
Outyears	90,400	90,400	90,400
Total, TEC[a]	**95,400**	**95,400**	**95,400**
Other Project Costs (OPC)			
FY 2019	1,500	1,500	1,500
Outyears	700	700	700
Total, OPC[b]	**2,200**	**2,200**	**2,200**
Total Project Costs (TPC)			
FY 2019	1,500	1,500	1,500
FY 2020	5,000	5,000	5,000
Outyears	94,100	94,100	94,100
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	8,500	N/A	N/A
Contingency	*1,500*	*N/A*	*N/A*
Total, Design	10,000	N/A	N/A
Construction			
Construction	68,400	N/A	N/A
Contingency	*17,000*	*N/A*	*N/A*
Total, Construction	85,400	N/A	N/A
Total, TEC[a]	**95,400**	**N/A**	**N/A**
Contingency, TEC	*18,500*	*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
Other Project Cost (OPC)			
OPC except D&D	2,000	N/A	N/A
Contingency	*200*	*N/A*	*N/A*
Total, OPC[b]	**2,200**	**N/A**	**N/A**
Contingency, OPC	*200*	*N/A*	*N/A*
Total Project Cost[a]	**97,600**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***18,700***	***N/A***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	Outyears	Total
FY 2020	TEC	—	5,000	90,400	95,400[a]
	OPC[b]	1,500	—	—	2,200
	TPC	1,500	5,000	90,400	97,600[a]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2027
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	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	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

[a] This project has not received CD-2 approval, 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 replacing existing facilities.

	Square Feet
New area being constructed by this project at *Lawrence Berkeley National Laboratory*	TBD
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
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	TBD

8. Acquisition Approach

The LBNL Management and Operating (M&O) Contractor, University of California will perform the acquisition for this project. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. The LBNL Site Office will be responsible for overseeing the performance of the M&O Contractor. Various acquisition and project delivery methods will be evaluated prior to achieving CD-1. The LBNL 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. Project performance metrics will be included in the M&O Contractor's annual performance and evaluation measurement plan.

[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-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 2020 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 $75,000,000. The preliminary Total Project Cost (TPC) range for this project is $48,900,000 to $76,900,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is $66,000,000 and the preliminary TPC point estimate for this project is $67,900,000.

The CEBAF center at TJNAF is currently overcrowded and has inadequate utility systems that are experiencing frequent failures. This project will renovate 67,000 to 80,000 gross square feet (gsf) of existing space in the CEBAF center, upgrade high risk utility systems, and provide 22,000 to 95,000 gsf of new space for visitors, users, research, education, and support.

Significant Changes

This project is a new start 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 2020 funds will support Project Engineering and Design (PED) activities.

A Federal Project Director has been assigned to this project and has approved this CPDS.

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	07/20/2018	4Q FY 2019	4Q FY 2019	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

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, 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	4,200	61,800	66,000[b]	1,900	N/A	1,900	67,900[a]

2. Project Scope and Justification

Scope

The CEBAF Renovation and Expansion project will renovate existing and provide new research, administrative, and support service space enabling TJNAF to better support current SC missions and planned mission growth. This project will renovate 67,000 to 80,000 gsf of existing space and provide 22,000 to 92,000 gsf of new office space for 120 to 200 research, education, and support staff. The renovation will include reconfiguration to provide more functional spaces that meet current code standards. Research and office spaces will be designed to meet evolving staff needs and provide a more efficient work environment, providing more functional meeting spaces. Ceilings will be removed and replaced to match the designed spaces.

The mechanical systems in the existing CEBAF Center, which have exceeded their service life and experienced multiple failures, will be replaced. The renovated building will be energy sustainable and will meet high performance building standards, including energy conservation, green building principles and sustainable design, and will be designed to meet Federal legislative objectives.

Upon completion, staff from the Applied Research Center (ARC) and Service Support Center (SSC) will be relocated into the CEBAF Center to more efficiently address functional workspace needs for TJNAF staff and users.

Justification

With a population of nearly 1600 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. Staff and user population is expected to increase 2% 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, and FRIB that are projected to require additional staffing. TJNAF will play a key role, potentially as lead, for the design and development of a major SC initiative.

Currently TNAF 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 consolidating workers currently housed in the ARC and SSC into a single facility. 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-agency 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.

The project will be conducted in accordance with the project management requirements in DOE Order 413.3B, and all appropriate project management requirements will be met.

Key Performance Parameters (KPPs) (Preliminary)

The project has not yet received CD-1 approval; therefore Key Performance Parameters are yet to be determined. The table below outlines preliminary KPPs.

Performance Measure	Threshold	Objective
CEBAF Center Renovation	67,000 GSF	80,000 GSF
CEBAF Center Expansion	22,000 GSF	92,000 GSF

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs[a]
Total Estimated Cost (TEC)			
Design			
FY 2020	2,000	2,000	2,000
Outyears	2,200	2,200	2,200
Total, Design	4,200	4,200	4,200
Construction			
Outyears	61,800	61,800	61,800
Total, Construction	61,800	61,800	61,800
Total Estimated Costs (TEC)			
FY 2020	2,000	2,000	2,000
Outyears	64,000	64,000	64,000
Total, TEC[b]	**66,000**	**66,000**	**66,000**
Other Project Costs (OPC)			
FY 2018	20	20	20
FY 2019	1,465	1,465	1,465
Outyears	415	415	415
Total, OPC[c]	1,900	1,900	1,900
Total Project Costs (TPC)			
FY 2018	20	20	20
FY 2019	1,465	1,465	1,465
FY 2020	2,000	2,000	2,000
Outyears	64,415	64,415	64,415
Total, TPC[b]	**67,900**	**67,900**	**67,900**

[a] Costs for FY 2019 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	3,400	N/A	N/A
Contingency	*800*	*N/A*	*N/A*
Total, Design	4,200	N/A	N/A
Construction			
Construction	49,800	N/A	N/A
Contingency	*12,000*	*N/A*	*N/A*
Total, Construction	61,800	N/A	N/A
Total, TEC[a]	66,000	N/A	N/A
Contingency, TEC	*12,800*	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D	1,900	N/A	N/A
Contingency	—	*N/A*	*N/A*
Total, OPC[b]	1,900	N/A	N/A
Total Project Cost[a]	67,900	N/A	N/A
Total Contingency (TEC+OPC)	***12,800***	***N/A***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2018	FY 2019	FY 2020	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]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2026
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	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	288	N/A	14,400	N/A
Utilities	432	N/A	21,600	N/A
Maintenance and Repair	1,008	N/A	50,400	N/A
Total—Operations and Maintenance	1,728	N/A	86,400	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 or procured by this project at *Thomas Jefferson National Accelerator Facility*	22,000–144,000
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
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	None

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. Various acquisition approaches and project delivery methods will be considered prior to achieving CD-1. The M&O contractor will be responsible for awarding and administering all subcontracts related to this project. Project performance metrics are included in the M&O contractor's annual performance evaluation and measurement plan.

[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-74, Craft Resources Support Facility
Oak Ridge National Laboratory, Oak Ridge, TN
Project is for Design and Construction

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

Summary

The FY 2020 Request for the Craft Resources Support Facility is $20,000,000. The preliminary Total Estimated Cost (TEC) range for this project is $24,500,000 to $40,000,000 and the preliminary Total Project Cost (TPC) range for this project is $25,000,000 to $40,500,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $40,000,000 and the most likely TPC for this project is estimated at $40,500,000.

This project will provide a new facility that will allow craft resource services currently located in inadequate facilities to be consolidated into one modern, efficient facility.

Significant Changes

This project is a new start 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 2020 funds will be used to support Project Engineering and Design (PED) activities and initiate construction 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 2020	07/20/2018	4Q FY 2019	4Q FY 2019[a]	3Q FY 2020[a]	3Q FY 2019	3Q FY 2020[a]	N/A	4Q FY 2023[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-2/3	CD-3A	CD-3B
FY 2020	3Q FY 2020[a]	3Q FY 2020[a]	N/A	N/A

CD-2/3 – Approve Performance Baseline and Start of Construction
CD-3A – Approve Long-Lead Procurements and Start of Early Construction
CD-3B – Approve Start of Remaining Construction Activities

[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	4,000	36,000	40,000[b]	500	N/A	500	40,500[b]

2. Project Scope and Justification

Scope

The Craft Resources Support Facility project will provide modern space with an appropriate design, configuration, and environmental conditions to maintain Oak Ridge National Laboratory (ORNL) infrastructure and support activities conducted at user, experimental, and developmental research facilities for multiple SC research programs. Craft resource services that are currently housed in multiple inadequate facilities spread across the 7000 area of ORNL will be consolidated into this new facility.

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 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.

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 including but not limited to hoist and rigging, welding and inspection, maintenance and repair garage, 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.

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

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

Key Performance Parameters (KPPs) (Preliminary)

The project has not yet received CD-1 approval; therefore Key Performance Parameters are yet to be determined. The table below outlines preliminary KPPs.

Performance Measure	Threshold	Objective
Craft services support building	40,000 gsf	60,000 gsf

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	16,000	16,000	10,000
Outyears	20,000	20,000	26,000
Total, Construction	36,000	36,000	36,000
Total Estimated Cost (TEC)			
FY 2020	20,000	20,000	14,000
Outyears	20,000	20,000	26,000
Total, TEC[a]	**40,000**	**40,000**	**40,000**
Other Project Cost (OPC)			
FY 2019	400	400	400
Outyears	100	100	100
Total, OPC[b]	500	500	500
Total Project Costs (TPC)			
FY 2019	400	400	400
FY 2020	20,000	20,000	14,000
Outyears	20,100	20,100	26,100
Total, TPC[a]	**40,500**	**40,500**	**40,500**

[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	3,500	N/A	N/A
Contingency	*500*	*N/A*	*N/A*
Total, Design	4,000	N/A	N/A
Construction			
Construction	30,000	N/A	N/A
Contingency	*6,000*	*N/A*	*N/A*
Total, Construction	36,000	N/A	N/A
Total, TEC[a]	**40,000**	**N/A**	**N/A**
Contingency, TEC	*6,500*	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Design	420	N/A	N/A
Contingency	*80*	*N/A*	*N/A*
Total, OPC[b]	**500**	**N/A**	**N/A**
Contingency, OPC	*80*	*N/A*	*N/A*
Total Project Cost[b]	**40,500**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***6,580***	***N/A***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	Outyears	Total
FY 2020	TEC	—	—	20,000	20,000	40,000[a]
	OPC[b]	—	400	—	100	500
	TPC	—	400	20,000	20,100	40,500[a]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2022
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	4Q FY 2072

[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	101	N/A	4,249
Utilities	N/A	146	N/A	6,141
Maintenance and Repair	N/A	194	N/A	8,161
Total—Operations and Maintenance	N/A	441	N/A	18,551

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*	40,000–60,000
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
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	40,000–60,000

8. Acquisition Approach

The ORNL Management and Operating (M&O) Contractor, UT-Battelle will perform the acquisition for this project. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. The ORNL Site Office will be responsible for overseeing the performance of the M&O Contractor. Various acquisition and project delivery methods will be evaluated prior to achieving CD-1. 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. Project performance metrics will be included in the M&O Contractor's annual performance and evaluation measurement plan.

[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 2020 Request for the Large Scale Collaboration Center is $3,000,000. The current preliminary Total Estimated Cost (TEC) range for this project is $32,000,000 to $60,000,000. The current preliminary Total Project Cost (TPC) range for this project is $33,000,000 to $61,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The most likely TEC for this project is estimated at $60,000,000 and the most likely TPC for this project is estimated at $61,000,000.

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

Significant Changes

This project is a new start 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 2020 funds will be used to 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 2020	7/20/2018	4Q FY 2019	4Q FY 2019[a]	4Q FY 2020[a]	4Q FY 2020	4Q FY 2020[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

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 2020	6,000	54,000[a]	60,000[a]	1,000	N/A	1,000	61,000[a]

[a] This project is pre-CD-2 and schedule and funding estimates are preliminary.
[b] Other Project Costs (OPC) are funded through laboratory overhead.

2. Project Scope and Justification

Scope

The Large Scale Collaboration Center project will construct an office building of approximately 38,000 to 45,000 gross square feet (gsf) to consolidate and provide space for 100-150 occupants in a common building 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, the LCLS-II-HE, the Stanford Synchrotron Radiation Laboratory (SSRL), Cryo-Electron Microscopy (EM), the 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. However, current office spaces near experimental areas are fully occupied or oversubscribed, and staff and users are projected to increase and exceed the 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 collaboration among teams 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, received 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), 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 sufficient office space 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, machine learning, artificial intelligence, exascale computing, data management, data acquisition, simulation, imaging, visualization, and modeling are also not currently available.

To address these capability gaps, SLAC proposes to construct a new Large Scale Collaboration Center that will enable SLAC to collocate cross-functional teams of SLAC and outside scientists in one building. This centralization will provide SLAC with the necessary performance capabilities to support and grow the science research 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) (Preliminary)

The project has not yet received CD-1 approval; therefore Key Performance Parameters are yet to be determined. The table below outlines preliminary KPPs.

Performance Measure	Threshold	Objective
Construction of a Multi-story Building	38,000 gsf	45,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2020	3,000	3,000	3,000
Outyears	3,000	3,000	3,000
Total, Design	6,000	6,000	6,000
Construction			
Outyears	54,000	54,000	54,000
Total, Construction	54,000	54,000	54,000
Total Estimated Costs (TEC)			
FY 2020	3,000	3,000	3,000
Outyears	57,000	57,000	57,000
Total, TEC[a]	**60,000**	**60,000**	**60,000**
Other Project Costs (OPC)			
FY 2019	700	700	700
Outyears	300	300	300
Total, OPC[b]	1,000	1,000	1,000
Total Project Costs (TPC)			
FY 2019	700	700	700
FY 2020	3,000	3,000	3,000
Outyears	57,300	57,300	57,300
Total, TPC[a]	**61,000**	**61,000**	**61,000**

[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	4,800	N/A	N/A
Contingency	*1,200*	*N/A*	*N/A*
Total, Design	6,000	N/A	N/A
Construction			
Construction	43,000	N/A	N/A
Contingency	*11,000*	*N/A*	*N/A*
Total, Construction	54,000	N/A	N/A
Total, TEC[a]	**60,000**	**N/A**	**N/A**
Contingency, TEC	*12,200*	*N/A*	*N/A*
Other Project Cost (OPC)[b]			
OPC except D&D			
OPC Costs	1,000	N/A	N/A
Contingency	—	*N/A*	*N/A*
Total, OPC	**1,000**	**N/A**	**N/A**
Contingency, OPC	—	*N/A*	*N/A*
Total Project Cost[a]	**61,000**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***12,200***	***N/A***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	Outyears	Total
FY 2020	TEC	—	3,000	57,000	60,000[a]
	OPC[b]	700	—	300	1,000
	TPC	700	3,000	57,300	61,000[a]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2026
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	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	81	N/A	4,050
Utilities	N/A	154	N/A	7,700
Maintenance and Repair	N/A	170	N/A	8,500
Total – Operations and Maintenance	N/A	405	N/A	20,250

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*.....	38,000-45,000
Area of D&D in this project at *SLAC National Accelerator Laboratory*	None
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	38,000-46,000

8. Acquisition Approach

The SLAC Management and Operating (M&O) contractor, Stanford University will perform the acquisition for this project. 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. Project performance metrics for SLAC will be included in the M&O contractor's annual performance and evaluation measurement plan.

[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 and 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 2020 Request for the Science and User Support Center is $6,400,000. This project has a preliminary Total Estimated Cost (TEC) range of $71,000,000 to $95,000,000 and a preliminary Total Project Cost (TPC) range of $72,000,000 to $96,000,000. The most likely TEC for this project is estimated at $85,000,000 and the most likely TPC for this project is estimated at $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 2020 funds will continue Project Engineering and Design (PED) activities and begin long lead procurement activities.

A Federal Project Director with the appropriate certification level 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	12/12/2016	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	12/12/2016	9/7/2018	12/18/2018	4Q FY 2020[a]	3Q FY 2021	4Q FY 2021[a]	N/A	4Q FY 2025[a]

CD-0 – Approve Mission Need
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 – Actual date the final design was completed
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D Work
CD-4 – Approve Project Completion

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

CD-3A – Approve Site Preparation

[a] This project is pre-CD-2; 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 2019	9,400	75,600[b]	85,000[b]	1,000	N/A	1,000	86,000[b]
FY 2020	9,400	75,600	85,000[b]	1,200	N/A	1,200	86,200[b]

2. Project Scope and Justification

Scope

The Science and User Support Center (SUSC) project received CD-1, Approve Alternative Selection and Cost Range, which identified a single new facility at BNL perimeter as the preferred alternative. It is currently conceived as a project 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.

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 the administrative support functions and provides easier visitor access to conferencing and collaboration space to support the Office of Science research agenda. 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 will 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 agenda 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.

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	7,000
FY 2020	2,400	2,400	2,400
Total, Design	9,400	9,400	9,400
Construction			
FY 2020	4,000	4,000	2,000
Outyears	71,600	71,600	73,600
Total, Construction	75,600	75,600	75,600
Total Estimated Costs (TEC)			
FY 2019	7,000	7,000	7,000
FY 2020	6,400	6,400	4,400
Outyears	71,600	71,600	73,600
Total, TEC[b]	85,000	85,000	85,000
Other Project Costs (OPC)[c]			
FY 2017	700	700	700
FY 2018	300	300	300
FY 2019	200	200	200
Total, OPC	**1,200**	**1,200**	**1,200**
Total Project Costs (TPC)			
FY 2017	700	700	700
FY 2018	300	300	300
FY 2019	7,200	7,200	7,200
FY 2020	6,400	6,400	4,400
Outyears	71,600	71,600	73,600
Total, TPC[b]	**86,200**	**86,200**	**86,200**

[a] Costs for FY 2019 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	N/A	N/A
Contingency	*1,600*	*N/A*	*N/A*
Total, Design	9,400	N/A	N/A
Construction			
Construction	63,000	N/A	N/A
Contingency	*12,600*	*N/A*	*N/A*
Total, Construction	75,600	N/A	N/A
Total, TEC[a]	**85,000**	**N/A**	**N/A**
Contingency, TEC	*14,200*	*N/A*	*N/A*
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	500	N/A	N/A
Conceptual Design	500	N/A	N/A
Contingency	*200*	*N/A*	*N/A*
Total, OPC[b]	**1,200**	**N/A**	**N/A**
Contingency, OPC	*200*	*N/A*	*N/A*
Total Project Cost[a]	**86,200**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***14,400***	***N/A***	***N/A***

5. Schedule of Appropriation Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	Outyears	Total
FY 2019	TEC	—	—	2,000	7,400	75,600	85,000[a]
	OPC[b]	—	1,000	—	—	—	1,000
	TPC	—	1,000	2,000	7,400	75,600	86,000[a]
FY 2020	TEC	—	—	7,000	6,400	71,600	85,000[a]
	OPC[b]	700	300	200	—	—	1,200
	TPC	700	300	7,200	6,400	71,600	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 (fiscal quarter or date)	4Q FY 2025
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	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	166	N/A	8,307
Utilities	N/A	78	N/A	3,879
Maintenance and Repair	N/A	384	N/A	19,200
Total – Operations and Maintenance	N/A	628	N/A	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. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. The Brookhaven Site Office will be responsible for overseeing the performance of the M&O Contractor. Various acquisition and project delivery methods will be evaluated prior to achieving CD-1. The 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. Project performance metrics will be included in the M&O Contractor's annual performance and evaluation measurement plan.

[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-72, Electrical Capacity and Distribution Capability
Argonne National Laboratory (ANL)
Project is for Design and Construction

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

Summary

The FY 2020 Request for the Electrical Capacity and Distribution Capability project is $30,000,000. This project has a preliminary Total Estimated Cost (TEC) range of $52,000,000 to $96,000,000 and a preliminary Total Project Cost (TPC) range of $53,000,000 to $97,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC for this project is estimated at $60,000,000 and the preliminary TPC for this project is estimated at $61,000,000.

This project will improve high voltage electrical distribution systems to support the anticipated electrical demands of the exascale computing program as well as current mission critical operations in multiple facilities across Argonne National Laboratory (ANL).

Significant Changes

This project was initiated in FY 2019. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on September 22, 2017. CD-1, Approve Alternative Selection and Cost Range, CD-3A, Approve Long-lead Procurement and Start of Early Construction Activities, and CD-3B, Approve Start of Remaining Construction Activities approvals are anticipated in FY 2019. FY 2020 funds will continue construction 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 2019	09/22/2017	N/A	4Q FY 2018	3Q FY 2019	2Q FY 2019	3Q FY 2019	N/A	4Q FY 2022
FY 2020	09/22/2017	N/A	2Q FY 2019[a]	4Q FY 2019[a]	2Q FY 2019	4Q FY 2019[a]	N/A	1Q FY 2023[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 2019	N/A	N/A	N/A
FY 2020	N/A	2Q FY 2019	4Q FY 2019

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 approval 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 2019	6,000	54,000	60,000	1,000	N/A	1,000	61,000
FY 2020	6,000	54,000	60,000[b]	1,000	N/A	1,000	61,000[b]

2. Project Scope and Justification

Scope

The scope of this project includes the design and construction of a new power supply to the site in a location physically separated from existing location such that redundancy is provided to prevent single point failure. Additionally, increased high voltage electrical capacity will be provided. Upgrades to supply lines and substations as well as redundant electrical connections will be analyzed and provided, if they prove to provide a positive benefit to cost ratio.

Justification

The high voltage electrical distribution system consists of substations, transformers, high voltage electrical supply, and distribution cabling. High voltage power is supplied to the laboratory via a single ComEd managed substation facility. Once on site, electricity is distributed through laboratory managed substations, transformers, and finally facilities. Elements of the high voltage electrical distribution system are rated in poor condition due to age, limiting the ability to support the electricity requirements of new and expanding facilities and scientific programs. Much of the main electrical supply infrastructure was constructed in the 1960's and is now beyond its useful life.

Mission critical improvements to the high voltage electrical distribution systems are needed to support ANL's unique competencies and eliminate these gaps. Expansion of the electrical distribution system would significantly reduce the risk of inadequate electrical capacity to support future scientific program growth and/or new initiatives; specifically those associated with advanced computer science, visualization, and data, large scale user facilities/advanced instrumentation and nuclear physics core capabilities. By filling these gaps, there will be a significant reduction in operational risk associated with unplanned outages. The Electrical Capacity and Distribution Capability project will improve and expand critical electrical distribution systems to support the electrical capacity growth needed to support the SC/Advanced Scientific Computing Research program's planned delivery of an exascale computer to the ANL Leadership Computing Facility. Other science facilities will also be positively impacted by these critical high voltage electrical and distribution upgrades such as the Advanced Photo Source and the Center for Nanoscale Materials.

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 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.

Performance Measure	Threshold	Objective
Upgrade High Voltage Electrical System & Supporting Infrastructure	CD-3: Construct new redundant high voltage supply transmission system to meet projected site loads (> 150 MVA)	Threshold Value plus: Potential line upgrades, new equipment, equipment replacements, various other electrical system reliability projects) to increase reliability of laboratory internal electrical distribution

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2019	6,000	6,000	6,000
Total, Design	6,000	6,000	6,000
Construction			
FY 2019	24,000	24,000	10,000
FY 2020	30,000	30,000	15,000
Outyears	—	—	29,000
Total, Construction	54,000	54,000	54,000
Total Estimated Costs (TEC)			
FY 2019	30,000	30,000	16,000
FY 2020	30,000	30,000	15,000
Outyears	—	—	29,000
Total, TEC[a]	**60,000**	**60,000**	**60,000**
Other Project Costs (OPC)			
OPC except D&D			
FY 2018	1,000	1,000	1,000
Total, OPC[b]	**1,000**	**1,000**	**1,000**
Total Project Cost (TPC)			
FY 2018	1,000	1,000	1,000
FY 2019	30,000	30,000	16,000
FY 2020	30,000	30,000	15,000
Outyears	—	—	29,000
Total, TPC[a]	**61,000**	**61,000**	**61,000**

[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	5,100	5,100	N/A
Contingency	*900*	*900*	*N/A*
Total, Design	6,000	6,000	N/A
Construction			
Construction	45,000	45,000	N/A
Contingency	*9,000*	*9,000*	*N/A*
Total, Construction	54,000	54,000	N/A
Total, TEC[a]	**60,000**	**60,000**	**N/A**
Contingency, TEC	*9,900*	*9,900*	*N/A*
Other Project Cost (OPC)[a]			
OPC except D&D			
Conceptual Planning	750	750	N/A
Conceptual Design	250	250	N/A
Contingency	—	—	*N/A*
Total, OPC	**1,000**	**1,000**	**N/A**
Contingency, OPC	—	—	*N/A*
Total Project Cost[b]	**61,000**	**61,000**	**N/A**
Total Contingency (TEC+OPC)	***9,900***	***9,900***	***N/A***

5. Schedule of Appropriation Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	Total
FY 2019	TEC	—	—	20,000	40,000	60,000[b]
	OPC[a]	—	1,000	—	—	1,000
	TPC	—	1,000	20,000	40,000	61,000[b]
FY 2020	TEC	—	—	30,000	30,000	60,000[b]
	OPC[a]	—	1,000	—	—	1,000
	TPC	—	1,000	30,000	30,000	61,000[b]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	1Q FY 2023
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	4Q FY 2073

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

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

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life-Cycle Costs	
	Previous Total Estimate	**Current Total Estimate**	**Previous Total Estimate**	**Current Total Estimate**
Operations	1,117	1,117	107,628	107,628
Utilities	162	162	21,571	21,571
Maintenance and Repair	536	536	51,646	51,646
Total – Operations and Maintenance	1,815	1,815	180,845	180,845

7. D&D Information

There is no new area being constructed in this construction project.

	Square Feet
New area being constructed by this project at *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 Management and Operating (M&O) Contractor, UChicago Argonne, LLC will perform the acquisition for this project, overseen by the Argonne Site Office. Various acquisition approaches and project delivery methods will be evaluated prior to achieving CD-1. A tailored Design-Build approach is being considered as the overall best project delivery method with the lowest risk to DOE. The M&O Contractor is responsible for awarding and administering all subcontracts related to this project. Project performance metrics are included in the M&O Contractor's annual performance evaluation and measurement plan.

[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 2020 Request for the Translational Research Capability project is $15,000,000. The preliminary Total Estimated Cost (TEC) range for this project is of $80,000,000 to $97,000,000. The preliminary Total Project Cost (TPC) range for this project is $81,500,000 to $98,500,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The TEC point-estimate for this project is $93,500,000 and the TPC point-estimate is $95,000,000.

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

Significant Changes

This project was initiated in FY 2019. This project was not included in the FY 2019 Congressional Request but was included in the FY 2019 Enacted Appropriation; therefore, this is the first PDS for this project. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on November 02, 2018. FY 2020 funds will support construction activities pending CD-3 approval in FY 2020.

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 2020	10/26/2017	7/20/2018	11/02/2018[a]	1Q FY 2020[a]	4Q FY 2019	1Q 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-3A – Approve Long-Lead Procurements and Start of Early Construction Activities
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

CD-2/3 – Approve Performance Baseline and Start of Construction Activities
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 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	9,700	83,800	93,500[b]	1,500	N/A	1,500	95,000[b]

2. Project Scope and Justification

Scope

The Translational Research Capability (TRC) project received CD-1, Approve Alternative Selection and Cost Range, which identified a single new facility as the preferred alternative. It is currently conceived as a project to provide 80,000 to 150,000 gross square feet (gsf) of laboratory, high bay, office, and collaboration space to support advancement in 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 capable of responding to the pressing demand to support advancement in computing and materials science in support of multidisciplinary research. The project is conceived to provide laboratory spaces that provide noise isolation, electromagnetic shielding, and low vibration to support research in the advancement of computing as well as wet laboratories, dry laboratories, and high bay space for materials science and advancement in computing.

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 table below outlines preliminary KPPs for this project.

Performance Measure	Threshold	Objective
Multifunction Laboratory and Office Building	79,900 gsf	115,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2019	9,700	9,700	9,700
Total, Design	9,700	9,700	9,700

[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)

	Budget Authority (Appropriations)	Obligations	Costs
Construction			
FY 2019	15,300	15,300	3,500
FY 2020	15,000	15,000	16,500
Outyears	53,500	53,500	63,800
Total, Construction	83,800	83,800	83,800
Total Estimated Costs (TEC)			
FY 2019	25,000	25,000	13,200
FY 2020	15,000	15,000	16,500
Outyears	53,500	53,500	63,800
Total, TEC[a]	**93,500**	**93,500**	**93,500**
Other Project Costs (OPCs)[b]			
OPC except D&D			
FY 2017	190	190	190
FY 2018	1,000	1,000	1,000
Outyears	310	310	310
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	25,000	25,000	13,200
FY 2020	15,000	15,000	16,500
Outyears	53,810	53,810	64,110
Total, TPC[a]	**95,000**	**95,000**	**95,000**

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	8,200	N/A	N/A
Contingency	*1,500*	*N/A*	*N/A*
Total, Design	9,700	N/A	N/A
Construction			
Construction	70,500	N/A	N/A
Contingency	*13,300*	*N/A*	*N/A*
Total, Construction	83,800	N/A	N/A
Total, TEC	**93,500**	**N/A**	**N/A**
Contingency, TEC	*14,800*	*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
Other Project Cost (OPC)[a]			
OPC except D&D			
Conceptual Planning	500	N/A	N/A
Conceptual Design	800	N/A	N/A
Contingency	*200*	*N/A*	*N/A*
Total, OPC	**1,500**	**N/A**	**N/A**
Contingency, OPC	*200*	*N/A*	*N/A*
Total Project Cost[b]	**95,000**	**N/A**	**N/A**
Total Contingency (TEC+OPC)	***15,000***	***N/A***	***N/A***

5. Schedule of Appropriation Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	Outyears	Total
FY 2020	TEC	—	—	25,000	15,000	53,500	93,500[b]
	OPC[a]	190	1,000	—	—	310	1,500
	TPC	190	1,000	25,000	15,000	53,810	95,000[b]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy Expected (fiscal quarter or date)	4Q FY 2025
Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	4Q FY 2075

7. D&D Information

	Square Feet
New area being constructed by this project at *Oak Ridge National Laboratory*...	80,000–115,000
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[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.....	80,000–115,000

8. Acquisition Approach

The ORNL Management and Operating (M&O) Contractor, UT-Battelle will perform the acquisition for this project. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. The ORNL Site Office will

[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] 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.

be responsible for overseeing the performance of the M&O Contractor. Various acquisition and project delivery methods will be evaluated prior to achieving CD-1. 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. Project performance metrics will be included in the M&O Contractor's annual performance and evaluation measurement 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 2020 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 $90,000,000 to $140,000,000. The preliminary Total Project Cost (TPC) range for this project is $92,200,000 to $142,200,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

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. This project was not included in the FY 2019 Congressional Request but was included in the FY 2019 Enacted Appropriation; therefore, this the first PDS for this project. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on March 13, 2018. FY 2020 funds will be used to continue 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 2020	03/13/2018	2Q FY 2019	3Q FY 2019[a]	4Q FY 2020[a]	2Q FY 2022[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	CD-3A	CD-3B
FY 2020	4Q FY 2020[a]	N/A	N/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 and 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	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 BioEPIC project will construct a new, state-of-the-art facility 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. Co-location 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 Department of Energy (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 will be conducted in accordance with the project management requirements in DOE Order 413.3B, and all appropriate project management requirements will be met.

Key Performance Parameters (KPPs)

The project has not yet received CD-1 approval; therefore Key Performance Parameters are yet to be determined. The table below outlines preliminary KPPs.

Performance Measure	Threshold	Objective
Biosciences and other research space	60,000 gross square feet	100,000 gross square feet

[a] Other Project Costs (OPC) are paid for through laboratory overhead.

[b] This project is pre-CD-2 and schedule and 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	6,000	6,000	6,000
Outyears	2,000	2,000	2,000
Total, Design	13,000	13,000	13,000
Construction			
Outyears	127,000	127,000	127,000
Total, Construction	127,000	127,000	127,000
Total Estimated Costs (TEC)			
FY 2019	5,000	5,000	5,000
FY 2020	6,000	6,000	6,000
Outyears	129,000	129,000	129,000
Total, TEC[a]	**140,000**	**140,000**	**140,000**
Other Project Costs (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	6,000	6,000	6,000
Outyears	129,700	129,700	129,700
Total, TPC[a]	**142,200**	**142,200**	**142,200**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	10,400	12,800	N/A
Contingency	*2,600*	*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**
Contingency, TEC	*24,600*	*24,200*	*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
Other Project Cost (OPC)[b]			
OPC except D&D			
Conceptual Design	1,300	1,300	N/A
Start-up	600	600	N/A
Contingency	*300*	*300*	*N/A*
Total, OPC	**2,200**	**2,200**	**N/A**
Contingency, OPC	***300***	***300***	***N/A***
Total Project Cost[a]	**142,200**	**142,200**	**N/A**
Total Contingency (TEC+OPC)	***24,900***	***24,500***	***N/A***

5. Schedule of Appropriation Requests

(dollars in thousands)

Request Year	Type	FY 2019	FY 2020	Outyears	Total
FY 2020	TEC	5,000	6,000	129,000	140,000[b]
	OPC[c]	1,500	—	700	2,200
	TPC	6,500	6,000	129,700	142,200[a]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	4Q FY 2027
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	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

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

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

7. D&D Information

The new area that will be constructed in this project will not replace existing facilities.

	Square Feet
New area being constructed by this project at *Lawrence Berkeley National Laboratory*	60,000–100,000
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 Berkeley Site Office. Various acquisition approaches and project delivery methods will be evaluated prior to achieving CD-1 including, but not limited to, a tailored Design-Bid-Build approach with a Construction Manager as General Contractor and design build. The M&O contractor is responsible for awarding and administering all subcontracts related to this project. Project performance metrics will be included in the M&O contractor's annual performance evaluation and measurement plan.

[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 2020 Request for the Energy Sciences Capability project is $9,000,000. The TEC for this project is $90,000,000 and the 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 2020 funds will support construction and associated activities.

A Federal Project Director with the appropriate certification level was 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	12/12/2016	N/A	4Q FY 2018	4Q FY 2019	N/A	4Q FY 2020	N/A	4Q FY 2025
FY 2019	12/12/2016	3Q FY 2018	2Q FY 2018	4Q FY 2019	4Q FY 2019	4Q FY 2019	N/A	4Q FY 2025
FY 2020	12/12/2016	3Q FY 2018	2/13/2018	12/7/2018	12/7/2018	12/7/2018	N/A	12/31/2023

CD-0 – Approve Mission Need
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was completed. Note the project has a Design-Build delivery method, so the design proceeds during construction activities.
CD-3– Approve Start of Construction
D&D Complete – Completion of D&D work (see Section 9)
CD-4 – Approve Project Completion

Fiscal Year	Performance Baseline Validation
FY 2018	4Q FY 2019
FY 2019	4Q FY 2019
FY 2020	12/7/2018

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

2. Project Scope and Justification

Scope

The scope of the proposed project is to construct new capital assets, including utilities and infrastructure capabilities. The ESC project will design, construct and turnover facilities and infrastructure that provides nominally 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 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, greater multidisciplinary collaboration, controlled environments, and increasing computational needs beyond current capabilities will be needed 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 0.25% available vacant lab space and less than 1.5% vacant office space 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" 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.

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 (Preliminary)

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
Total Estimated Cost (TEC)			
Design			
FY 2018	9,000	9,000	200
FY 2019	—	—	8,800
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	9,000	9,000	20,000
FY 2021	20,000	20,000	20,000
FY 2022	17,000	17,000	15,000
FY 2023	—	—	6,000
Total, Construction	81,000	81,000	81,000
TEC			
FY 2018	20,000	20,000	200
FY 2019	24,000	24,000	28,800
FY 2020	9,000	9,000	20,000
FY 2021	20,000	20,000	20,000
FY 2022	17,000	17,000	15,000
FY 2023	—	—	6,000
Total, TEC	**90,000**	**90,000**	**90,000**
Other Project Cost (OPC)[a]			
OPC except D&D			
FY 2017	839	839	839
FY 2018	400	400	400
FY 2023	1,761	1,761	1,761
Total, OPC except D&D	3,000	3,000	3,000
Total Project Cost (TPC)			
FY 2017	839	839	839
FY 2018	20,400	20,400	600
FY 2019	24,000	24,000	28,800

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

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
FY 2020	9,000	9,000	20,000
FY 2021	20,000	20,000	20,000
FY 2022	17,000	17,000	15,000
FY 2023	1,761	1,761	7,761
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	N/A
Contingency	*1,500*	*1,500*	*N/A*
Total, Design	9,000	9,000	N/A
Construction			
Construction	70,000	70,000	N/A
Contingency	*11,000*	*11,000*	*N/A*
Total, Construction	81,000	81,000	N/A
Total, TEC	**90,000**	**90,000**	**N/A**
Contingency, TEC	*12,500*	*12,500*	*N/A*
Other Project Cost (OPC)[a]			
OPC except D&D	1,650	1,650	N/A
Conceptual Planning	100	100	N/A
Conceptual Design	1,000	1,000	N/A
Contingency	*250*	*250*	*N/A*
Total, OPC	**3,000**	**3,000**	**N/A**
Contingency, OPC	*250*	*250*	*N/A*
Total Project Cost	**93,000**	**93,000**	**N/A**
Total, Contingency	***12,750***	***12,750***	***N/A***

5. Schedule of Appropriation Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2018	TEC	—	20,000	TBD	TBD	TBD	TBD	TBD	TBD	90,000
	OPC[a]	—	—	—	—	—	—	—	—	3,000
	TPC	—	20,000	TBD	TBD	TBD	TBD	TBD	TBD	93,000
FY 2019	TEC	—	1,000	4,000	8,194	22,209	30,500	24,097	—	90,000
	OPC[a]	1,100	1,500	—	—	—	—	400	—	3,000
	TPC	1,100	2,500	4,000	8,194	22,209	30,500	24,497	—	93,000

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

(dollars in thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2020	TEC	—	20,000	24,000	9,000	20,000	17,000	—	—	90,000
	OPC[a]	839	400	—	—	—	—	1,761	—	3,000
	TPC	839	20,400	24,000	9,000	20,000	17,000	1,761	—	93,000

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy (fiscal quarter or date)	1Q FY 2024
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	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

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*	110,000–145,000
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
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	None

8. Preliminary Acquisition Approach

The Management and Operating (M&O) contractor, Battelle Memorial Institute will perform the acquisition for this project, overseen by the Pacific Northwest Site Office. Various acquisition approaches and project delivery methods will be considered prior to achieving CD-1. The M&O contractor will be responsible for awarding and administering all subcontracts related to this project. Project performance metrics are included in the M&O contractor's annual performance evaluation and measurement plan.

[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), Batavia, IL
Project is for Design and Construction

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

Summary

The FY 2020 Request for the Integrated Engineering Research Center project is $10,000,000. 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 TEC for this project is estimated at $85,000,000 and the preliminary TPC for this project is estimated at $86,000,000.

This project will construct new space to accommodate increased collaboration and interactions among 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-1, Approve Alternative Selection and Cost Range, which was approved on April 18, 2017. FY 2020 funds will support the continuation of construction and associated activities.

A Federal Project Director with the appropriate certification level 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	07/17/2015	N/A	1Q FY 2017	3Q FY 2018[a]	N/A	3Q FY 2019[a]	N/A	4Q FY 2023[a]
FY 2018	07/17/2015	N/A	4/18/2017	3Q FY 2019[a]	N/A	3Q FY 2020[a]	N/A	4Q FY 2024[a]
FY 2019	07/17/2015	3Q FY 2018	4/18/2017	3Q FY 2019[a]	3Q FY 2019[a]	3Q FY 2020[a]	N/A	4Q FY 2024[a]
FY 2020	07/17/2015	4/18/2017	4/18/2017	3Q FY 2019[a]	3Q FY 2019[a]	3Q FY 2019[a]	N/A	2Q FY 2024[a]

CD-0 – Approve Mission Need
Conceptual Design Complete – Actual date the conceptual design was completed
CD-1 – Approve Alternative Selection and Cost Range
CD-2/3A – Approve Performance Baseline/Long Lead Procurement
Final Design Complete – Actual date the final design was completed
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D Work (see section 9)
CD-4 – Approve Project Completion

[a] This project is pre-CD-2 and schedule estimates are preliminary.

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

CD-3 – Approve Start of Construction

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]

2. Project Scope and Justification

Scope

The Integrated Engineering Research Center project will construct a scientific user support facility to accommodate increased collaboration and interactions among staff at Fermilab (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.

Co-location 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 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 Integrated Engineering Research Center will provide FNAL with a collaborative, multi-divisional, and interdisciplinary research center. This research center will close existing capability

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

[b] This project has not received CD-2 approval; funding estimates are consistent with the approved cost ranges.

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 will be conducted in accordance with the project management requirements in DOE Order 413.3B, and all appropriate project management requirements will be met.

Key Performance Parameters (KPPs)

Performance Measure	Threshold	Objective
Multistory Laboratory/Office Building	67,000 gross square feet	134,000 gross square feet

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	5,000
FY 2019	—	—	1,962
Total, Design	7,000	7,000	7,000
Construction			
FY 2018	15,500	15,500	—
FY 2019	20,000	20,000	10,000
FY 2020	10,000	10,000	20,000
Outyears	32,500	32,500	48,000
Total, Construction	78,000	78,000	78,000
TEC			
FY 2017	2,500	2,500	38
FY 2018	20,000	20,000	5,000
FY 2019	20,000	20,000	11,962
FY 2020	10,000	10,000	20,000
Outyears	32,500	32,500	48,000
Total, TEC[b]	**85,000**	**85,000**	**85,000**
Other Project Cost (OPC)[c]			
OPC except D&D			
FY 2015	120	120	120
FY 2016	510	510	510
FY 2017	300	300	300
Outyears	70	70	70

[a] Costs through 2017 reflect actual Costs; costs for FY 2018 and the outyears are estimates.

[b] This project has not received CD-2 approval; funding estimates are consistent with the approved cost ranges.

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

[d] Costs through 2017 reflect actual Costs; costs for FY 2018 and the outyears are estimates.

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs[a]
Total, OPC except D&D	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	5,000
FY 2019	20,000	20,000	11,962
FY 2020	10,000	10,000	20,000
Outyears	32,570	32,570	48,070
Total, TPC[b]	**86,000**	**86,000**	**86,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	6,000	8,000	N/A
Contingency	*1,000*	*2,000*	*N/A*
Total, Design	7,000	10,000	N/A
Construction			
Construction	63,000	61,000	N/A
Contingency	*15,000*	*14,000*	*N/A*
Total, Construction	78,000	75,000	N/A
Total, TEC[a]	**85,000**	**85,000**	**N/A**
Contingency, TEC	*16,000*	*16,000*	*N/A*
Other Project Cost (OPC)[b]			
OPC except D&D			
Conceptual Planning	250	250	N/A
Conceptual Design	530	530	N/A
Start-up	150	150	N/A
Contingency	*70*	*70*	*N/A*
Total, OPC	1,000	1,000	N/A
Contingency, OPC	*70*	*70*	*N/A*
Total Project Cost[b]	**86,000**	**86,000**	**N/A**
Total, Contingency	***16,070***	***16,070***	***N/A***

[a] This project has not received CD-2 approval; funding estimates are consistent with the approved cost ranges.

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

5. Schedule of Appropriation Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2017	FY 2018	FY 2019	FY 2020	Outyears	Total
FY 2017	TEC	—	2,500	TBD	TBD	TBD	TBD	85,000[a]
	OPC[b]	500	—	TBD	TBD	TBD	TBD	2,000
	TPC	—	2,500	TBD	TBD	TBD	TBD	87,000[a]
FY 2018	TEC	—	2,500	1,500	TBD	TBD	TBD	85,000[a]
	OPC[b]	500	—	500	—	—	—	1,000
	TPC	500	2,500	2,000	TBD	TBD	TBD	86,000[a]
FY 2019	TEC	—	2,500	1,500	5,000	20,000	56,000	85,000[a]
	OPC[b]	630	300	—	—	—	70	1,000
	TPC	630	2,800	1,500	5,000	20,000	56,070	86,000[a]
FY 2020	TEC	—	2,500	20,000	20,000	10,000	32,500	85,000[a]
	OPC[b]	630	300	—	—	—	70	1,000
	TPC	630	2,800	20,000	20,000	10,000	32,570	86,000[a]

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy Expected (fiscal quarter or date)	2Q FY 2024
Expected Useful Life (number of years)	50
Expected Future Start of D&D of this capital asset (fiscal quarter)	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	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

[a] This project has not received CD-2 approval; funding estimates are consistent with the approved cost ranges.

[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 *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

8. Acquisition Approach

The Management and Operating (M&O) contractor, Fermi Research Alliance, LLC will perform the acquisition for this project, overseen by the Fermi Site Office. Various acquisition approaches and project delivery methods were evaluated prior to achieving CD-1. A Construction Manager/General Contractor (CM/GC) project delivery with best value procurement approach was selected 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. Project performance metrics are included in the M&O contractor's annual performance evaluation and measurement plan.

[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.