

**Statement of Mission Need
for the
Stanford Linear Accelerator Center
Research Support Building and Infrastructure
Modernization Project**

Non-Major System Acquisition Project

Submitted August 2008

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Department of Energy
650-926-3208**

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A. Statement of Mission Need

The mission of the Department of Energy's Office of Science is to deliver the remarkable discoveries and scientific tools that transform our understanding of energy and matter and advance the national, economic, and energy security of the United States. The Office of Science executes this mission by managing fundamental research programs in basic energy sciences, biological and environmental sciences, high energy and nuclear physics, fusion and computational science. In addition, the Office of Science is the Federal Government's largest single funder of materials and chemical sciences, and it supports unique and vital parts of U.S. research in climate change, geophysics, genomics, life sciences, and science education.

Another critical element in the execution of this mission is the management of 10 world-class laboratories, which often are called the "crown jewels" of our national research infrastructure. The national laboratory system, created over a half-century ago, is the most comprehensive research system of its kind in the world. The mission of the Science Laboratories Infrastructure (SLI) program within the Office of Science (SC) is to support the conduct of Departmental research missions at SC laboratories by funding line item construction for revitalization and repair of the general-purpose infrastructure, and by cleaning up and removing excess facilities that are not transferable to the Office of Environmental Management.

The Stanford Linear Accelerator Center (SLAC) is an SC laboratory that supports a large national and international community of scientific users performing cutting edge research in support of the Department of Energy mission. Success of that mission is directly coupled to the general purpose infrastructure necessary to conduct this research. At SLAC the accomplishment of that mission is currently at risk given sub-standard buildings that do not provide the appropriate environment to conduct world class science or the supporting Management and Operations (M&O) functions.

SLAC is moving from a single program laboratory to a multi-program laboratory. This transition, combined with the condition and age of SLAC facilities, drives the need to consolidate core research functions and modernize key support buildings. The most pressing infrastructure gaps are the lack of appropriate space to consolidate accelerator scientists that are currently spread across the laboratory in outdated facilities, and the inefficiency of multiple facilities that house several of the Laboratory's key M&O functions.

B. Analysis to Support Mission Need

SLAC is operated by Stanford University for the Department of Energy's Office of Science. SLAC's primary mission focus is designing, constructing, and operating state-of-the-art electron accelerators and related experimental facilities to advance the boundaries of scientific understanding.

SLAC was founded in 1962 to perform accelerator-based particle physics. The Laboratory mission has since broadened to include photon science and non-accelerator-based particle physics. Current user facilities that serve the mission of the Office of Science include the Linac Coherent Light Source (LCLS), currently under construction. LCLS, the world's first X-ray free-electron laser, positions SLAC to become the world leader in the exciting new field of ultrafast X-ray science. SLAC operates a forefront synchrotron light source program, the Stanford Synchrotron Radiation Laboratory (SSRL), which provides a resource to the user community for probing the electronic and atomic structure of matter. The B-factory, an electron-positron collider, completed operations in 2008, but an intensive data analysis program will continue for several years. SLAC is home to the Instrument Operations Center for the Large Area Telescope instrument on the Gamma Ray Large Area Space Telescope (GLAST) that was launched in June, 2008. These major SLAC facilities support a user community of approximately 3,000 students and scientists from the U.S. and around the world. To date, six scientists have been awarded the Nobel Prize for work carried out at SLAC.

The foundational core competencies underpinning activities at SLAC as identified in SLAC's Laboratory Plan are:

- Electron-based accelerator research and technology
- Advanced instrumentation, diagnostics, and systems integration
- Innovative techniques for data analysis, modeling, simulation, and theory in Photon Science, Particle Physics and Particle Astrophysics
- Management of ultra-large data sets for users and collaborations distributed worldwide

In the future, these four competencies will enable SLAC to deliver its mission and customer focus, to perform a complementary role in the DOE laboratory system, and to pursue its vision for scientific excellence and pre-eminence in areas of:

- Development and application of ultrafast X-ray science
- X-ray probes of the electronic and atomic structure of matter
- Understanding the fundamental forces of nature and the physics of the birth and evolution of the universe
- Advancing the world's electron accelerator capability

Improvements to laboratory infrastructure are needed to support SLAC's future mission as an integrated laboratory optimally supporting the Office of Science Mission in its chosen areas of expertise. As the laboratory transitions from its single program past to its multi program future, our goal is a unified culture with a strong sense of community between all the scientific and support functions across the laboratory. We need the infrastructure to support an aligned team that is dedicated to success through coherent efforts across the site to achieve the best outcome for the laboratory as a whole.

The most critical infrastructure need is modern space sufficient to allow the collocation of the Accelerator Science and Technology program at the laboratory. SLAC's accelerator science program is essential to the future science strategy of four SLAC business lines: the LCLS upgrades, current and future synchrotron facilities on the site, the photon science institutes that will exploit the next generation X-ray sources, and accelerator based particle physics. In this way accelerator science is a cornerstone for future development of SLAC as a whole.

Currently the accelerator scientists and technology functions are largely distributed by mission (Particle Physics, SSRL, LCLS). The laboratory infrastructure does not facilitate communications and cross program activities. Sufficient space is not currently available to integrate the accelerator physics community and core technology support across programmatic boundaries at the site. As a result, this core competency is not fully able to effectively support the future major mission activities of the laboratory that rely on the lab's accelerator competency. In addition, current space is outdated and does not facilitate attracting and retaining top quality scientists and technical staff.

A portion of Accelerator Science staff are currently located in a group of trailers that were purchased in the mid 1960s to house SLAC's computer science effort. In 1975 that effort moved to a new computer building, building 50. The space was reconfigured in 1976 into roughly its current configuration for the PEP project staff. A number of groups have occupied the space since then and each time it was considered to be temporary. These trailers have exceeded their useful lives, and need to be demolished once appropriate space is available to consolidate accelerator scientists currently in these and other substandard facilities across SLAC. This collocation will result in substantial centralizing of the accelerator efforts at the Laboratory.

In addition to consolidating accelerator science, the laboratory is reorganizing and modernizing its M&O functions. The goal is to improve the support to the science mission, making the science staff more efficient and to reduce the cost of business making more funds available to the support science.

Three facilities that currently house these M&O functions are inadequate to fully support the Laboratory's needs. These are Building 24, Building 41, and Building 3.

- Building 24 was built as part of the original laboratory construction in 1964. Currently, it houses the Environment, Safety and Health (ES&H) Division in a portion of the building previously converted to office space and the remainder is high-bay shop space. This facility is configured in an inefficient manner with ineffective lighting, inadequate heating, ventilation and air conditioning (HVAC) which do not meet the current energy efficiency requirements (Executive Order 13423). Electrical power is adequate but the feeders and distribution conduit are old and in need of replacement to ensure efficiency, reliability, and code compliance. This facility also lacks an elevator, which is needed to comply with the Americans with Disabilities Act.
- Building 41 was also built as part of the original laboratory complex in 1963. It housed the Administration and Engineering functions. Currently, it houses the Business Services Division, some components of accelerator science, the Stanford Site Office and pieces of administration and support functions from a wide assortment of activities. The interior space has been reconfigured many times resulting in many inefficient spaces.

The HVAC for the building is inefficient and does not comply with E.O. 13423. The building does not have an elevator and therefore is not compliant with the Americans with Disabilities Act. In addition, the current configuration of the first floor in particular is inefficient for its current use.

- Building 3 housed the original Central Control Room for the linac and was built in 1964. In the 1980s control of the accelerator was moved to building 5 which is closer to the experimental area. The ability to reconfigure the space has been hampered by the relay racks in the control area that still have wiring in them that is critical to the operation of the linac. As a result, much of the building cannot be used effectively. That hindrance is being removed as part of the modernization of the control system for the Linac Coherent Light Source.

Currently, the building is occupied by ES&H Division and houses a make-shift training center and the Radiation Physics group. Trained personnel are required to support the safe conduct of the experiments and science at SLAC and to meet the safety expectations of both the Office of Science and SLAC; however, current training efforts are seriously impeded by the inefficient use of space in this building. The electrical capacity appears adequate; however the feeder cables and conduits are in need of replacement for efficiency, reliability and code compliance reasons. The HVAC system is not optimized.

To correct these deficiencies, a new building is proposed to house the laboratory's accelerator science community and replace 40 year old trailers. This will allow for the integration of the accelerator science and technology community across programmatic boundaries and allow them to optimally support the future programs at the laboratory. In addition, SLAC proposes to renovate the three buildings (3, 24, and 41) discussed above that currently house key mission support functions. Overall, the proposed project will upgrade working conditions for over 20% of the laboratory staff in a way that supports the laboratory vision of a unified culture with a strong sense of community between all scientific and support functions across the laboratory. The renovation of these three buildings is anticipated to decrease the deferred maintenance by \$2,000,000. Although the buildings are safe for occupancy, the condition of the work spaces threatens the functionality of the laboratory because they do not promote collaboration and act as a deterrent in attracting and retaining top staff members.

In summary, SLAC currently lacks appropriate space to consolidate accelerator scientists that are currently spread across the laboratory in outdated facilities. In addition, SLAC operations suffer from the inefficiency of multiple facilities that house several of the Laboratory's key M&O functions. These capability gaps need to be addressed in order to:

- Provide staff with safe, modern, fully compliant spaces that support 21st-century science.
- Provide general purpose research and institutional structures to allow the co-location of related groups with shared interests and mission objectives.
- Co-locate accelerator scientists to enable interaction among researchers and graduate students who have complementary interests that will support all accelerator based research programs at the laboratory and optimize cross program collaboration.

- Strengthen ties and interactions between related areas of research and support functions.

C. Importance of Mission Need and Impact if Not Approved

SLAC's ability to meet its mission goals is directly coupled to the infrastructure available to support effective functionality in accelerator research and technology as well as in critical mission support functions. As SLAC transforms itself from a single-program laboratory into a multi-program laboratory, its success will rely on the ability to improve current functionality to support the ongoing strategic diversification of the science mission as described in the laboratory business plan. Currently these efforts are hindered by the splitting of mission critical functions in several locations.

In order for SLAC to enhance its position as a world-class research institution, the Laboratory's physical facilities must fully support the needs of its forefront research programs, and these facilities must be maintained in a condition that provides a professional work environment. Currently, critical laboratory staff in accelerator science and technology and in critical mission support functions are housed in aging facilities which are demoralizing and decrease effective exchange of ideas among staff members. Balkanization by program across the laboratory is facilitated by the distribution of like activities across the site. The resulting duplication of effort and non standardization of functionality is an impediment to the current effort to modernize the functioning of the laboratory. In addition, the current facilities are substandard, making recruitment and retention of high quality staff a challenge and perpetuating a culture where critical mission support activities such as ES&H are considered second class to the science mission activities of the laboratory. Failure to provide modern facilities suitable for co-located and coordinated functionality will seriously challenge the laboratory's ability to successfully address and deliver on the long term strategic mission of the laboratory.

The accelerator science and technology challenges that were outlined in the Laboratory Business Plan require significant interaction between the accelerator scientists who have traditionally supported the operations of the HEP facilities on site with the SSRL accelerator physicists and the community that has traditionally focused on accelerator research germane to the HEP long term future. Effective coupling between accelerator operations and research activities is already challenged at the laboratory because the efforts are dispersed across the site. The failure to co-locate the accelerator research and technology functions at the laboratory will hinder the evolution of SLAC's outstanding accelerator science and technology efforts to optimally support the growing basic energy sciences funded accelerator efforts at the laboratory. Technical progress in areas such as designs for high-current, low emittance electron and positron storage rings, advanced electron guns for high brightness X-ray free electron lasers, novel bunch compression technology and rf-based undulators, and research into ultrahigh gradient acceleration based on laser or beam-driven plasma wakefield techniques all will be greatly enhanced by strong cross program collaboration and coordination.

SLAC is currently undergoing major needed structural changes to evolve the laboratory to modern management practices. A large part of this effort, encompassed by the vision of 'One Lab', is to ensure that across the laboratory all mission support activities openly collaborate to simplify, define and achieve the "one best" solution to problems while eliminating duplication of

effort and distraction. The current Balkanization and distribution of like functions around the laboratory, and the resulting duplication of effort and non standardization of functionality, is an impediment to the current effort to modernize the functioning of the laboratory. The upgrading of the physical infrastructure will allow us to co-locate like functions and facilitate the transition to modern management practices at the lab. Modernization of the M&O functionality of the laboratory is essential to ensure the success of the strategic diversification of the laboratory mission that is currently underway. The failure to upgrade the working conditions for the M&O function of the laboratory perpetuates a culture where critical mission support activities such as ES&H are considered second class to the science mission activities of the laboratory.

The following project alternatives will be further analyzed in the conceptual design phase to ensure the proposed strategy is the most cost-effective method of meeting the identified mission need.

- a. *Maintaining the Status Quo (no action)* – Under this alternative, SLAC will continue to operate the current facilities.
- b. *Improving Existing Structures* – Under this alternative, no new construction will be performed; instead, existing facilities will be renovated to eliminate deferred maintenance and address compliance issues.
- c. *Decommissioning and demolishing Current Facilities and Building New Ones to Replace Them* – Under this alternative, all of the facilities currently housing these staff will be demolished and replaced with new construction.
- d. *Replacing and Renovating* – This alternative will renovate existing facilities that are structurally and functionally sound, and will replace those that are not with new space.
- e. *Performing This Work at Another Location* (i.e., another laboratory or a university).

D. Constraints and Assumptions

Operational Limitations

Depending on the selected alternative, short-term interruptions of site utilities to other parts of the laboratory are possible, but would be scheduled for minimum impact, and the project team would assure that the affected parties are notified well in advance. Any needed relocation of staff will be scheduled to minimize impacts to ongoing activities.

There are no unusual operational limitations in effectiveness, capacity, technology, organizations or other special consideration associated with this project.

Geographic, Organizational and Environmental Limitations

There are no known geographical or environmental location limitations.

Standardization and Standards Requirements

The project will be designed and the work executed in accordance with applicable Public Laws, Executive Orders, OMB Circulars, Federal Property Management Regulations, and DOE Orders. New construction or renovations associated with this project will conform to the 2007 California Building Code and SLAC structural engineering guidelines. All systems

will be designed to applicable ASHRAE standards, and the work will be consistent with current DOE policy regarding LEED certification. Planning, acquisition, siting, designing, building, operating, and maintenance decisions for this project will be based on considerations of High Performance and Sustainable Buildings principles. All new equipment and systems will be selected to maximize energy efficiencies and “green” building technologies.

Environment, Safety and Health

This project will comply with all requirements of the National Environmental Policy Act (NEPA) and its implementing regulations and a NEPA determination would be made prior to taking any action on the proposed project that could have adverse environmental effects or that would limit the choice of reasonable alternatives. Some materials in existing buildings on-site are known to contain asbestos and the potential exists for lead in paint. All such material will be removed by a licensed subcontractor experienced in abatement of these materials.

A member of SLAC’s Environmental Safety and Health Department (ES&H), along with Facilities Department safety coordinators, will oversee personnel safety in compliance with Occupational Safety and Health Administration requirements and SLAC ES&H requirements and policies. The ES&H coordinators will manage the safety interface between SLAC and the construction contractor(s) as needed. Depending on the selected alternative, electrical safety may be of concern (e.g., during building refurbishment) and the Integrated Project Team (IPT) would include an electrical safety expert as a member.

This project will conform to the earthquake standards at SLAC and meet current California building codes and environmental regulations regarding protection of air and water.

Safeguards and Security

The safeguards and security requirements associated with this project will be consistent with those encountered in a typical construction project. The activities planned for these spaces are unclassified, and no safeguards and security issues during design and construction are foreseen.

Interfaces with Existing and Planned Acquisitions

No known interfaces have been identified with existing or planned acquisitions beyond this project.

Affordability Limits on Investment

The preliminary Total Estimated Cost (TEC) for this project ranges from \$80.0 million to \$96.0 million. The Total Project Cost (TPC) range for this project is \$81.0 million to \$97.4 million. A design-to-cost approach will be used to constrain design activities. Acquisition for design services will incorporate requirements to ensure construction cost estimates reflect the latest market conditions. In addition, the cost for the project will be managed by implementing value engineering and design reviews.

Goals for Limitations on Recurring or Operating Costs

No new operating costs are anticipated. The overall energy usage may be somewhat lower because of the opportunity to install energy efficient systems and lighting in upgraded spaces.

Legal and Regulatory Constraints or Requirements

The project will be in full compliance with all applicable Federal, state and local requirements. There are no known legal or regulatory issues that could adversely impact the project. The project would also comply with DOE Orders and best management practices.

Stakeholder Considerations

No significant stakeholder issues are anticipated. Internal and external stakeholders will be extensively involved in the planning and implementation of each phase of the project in order to minimize the disruption to the scientific programs and goals.

Technology Status and Engineering

This project is expected to involve conventional construction. All proposed work can be accomplished with current technology and methods. No research or development is required.

Technical Requirements

A detailed alternatives analysis will be completed prior to CD-1. The currently proposed project scope would include construction of roughly 53,000 to 58,000 gross square feet of new space to support Accelerator Science research, renovation of three existing facilities, and demolition of off-setting space.

E. Applicable Conditions and Interfaces

Project Location and Site Conditions

This project is not expected to require unusual site conditions or locations.

Project Interfaces and Integration Requirements

Other programs at SLAC would plan and execute any necessary moves of the current occupants of these spaces to other locations at SLAC. That work would be coordinated with this project so that the space is available for new construction, renovation, or demolition as required.

One-for-One Replacement

Congress established a requirement for elimination of excess buildings and facilities equivalent to the square footage of each new construction project. Any increase in square footage from this project will be addressed through demolition of existing facilities on site.

F. Resource Requirements and Schedule

For the purpose of the mission need analysis, the following preliminary costs and schedule are based on construction of a new facility that meets the capabilities required to close the performance gap and is roughly 53,000 to 58,000 gross square feet, renovation of three existing facilities, and demolition of offsetting space. The preliminary TPC range for this project is \$81.0 million to \$97.4 million. This list of resource requirements and schedule includes design, construction, project management, quality assurance and contingency. There is reasonable confidence in this estimate because it is based on experience with the construction of similar facilities on this site.

Critical Decision Point	Completion
CD-0, Approval Mission Need	1Q FY 2009
CD-1, Approve Alternative Selection and Cost Range	3Q FY 2009
CD-2, Approve Performance Baseline	3Q FY 2010
CD-3, Approve Start of Construction	1Q FY 2011
CD-4, Approve Start of Operations	3Q FY 2015

Table 1. Preliminary Schedule

Preliminary Funding Profile (millions of dollars):

	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Total
OPC	\$0.5		\$0.2	\$0.2	\$0.2	\$0.2	\$0.1	\$1.4
PED		\$8.9						\$8.9
Construction			\$33.1	\$19.7	\$22.0	\$12.3		\$87.1
Total TEC		\$8.9	\$33.1	\$19.7	\$22.0	\$12.3		\$96.0
Total TPC	\$0.5	\$8.9	\$33.3	\$19.9	\$22.2	\$12.5	\$0.1	\$97.4

Table 2. Preliminary Funding Profile

G. Development Plan

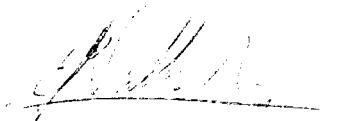
The Associate Director for the Office of Science, Office of Safety, Security and Infrastructure, will serve as the Acquisition Executive after the Acquisition Strategy is signed by the Under Secretary for Science and will approve remaining critical decisions. The Federal Project Director, with the support of the DOE-SSO and the Integrated Project Team, will provide overall project management oversight and approve key project documents. Stanford University, as the Management and Operating contractor for SLAC, will furnish engineering support and

management support services, and administer all design and construction subcontracts. Preliminary work would be managed by the Facilities Engineering and Construction Department until an integrated project team (IPT) is designated prior to CD-1.


Planning meetings will begin once CD-0 is approved. If and when this occurs, these meetings will include project stakeholders, the project team, and an Architect and Engineering firm, who will develop the space plan for the upgrades of the existing buildings and establish the design schedule for the new building while staying within the budget constraints of this project.

The undersigned have reviewed the mission need for this project and concur that it is needed to better accomplish the DOE's missions being performed by the laboratory in a cost-effective, reliable, safe and productive manner.

Concurrences

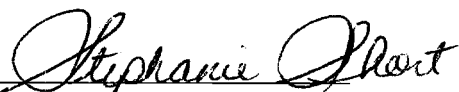

Evaristo J. Valle, SC-SSO
Federal Project Director
Stanford Site Office

9/18/08
Date

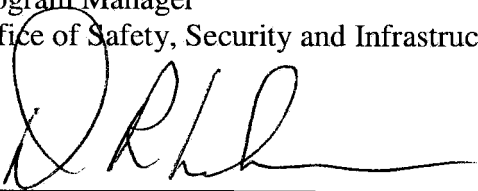

Paul Golan, SC-SSO
Site Manager
Stanford Site Office

Sept 18, 2008
Date

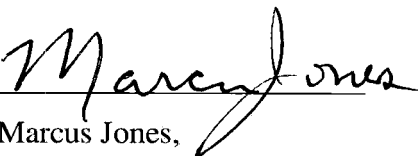
Recommend for Approval


Stephanie Short, SC-31
Program Manager
Office of Safety, Security and Infrastructure

9-23-08
Date


Daniel R. Lehman,
Director
Office of Project Assessment

9/24/08
Date


Marcus Jones,
Associate Director
Office of Safety, Security and Infrastructure

9/24/2008
Date

Approval

After reviewing the project justification material, including the positive recommendation from the Office of Project Assessment, I find the Statement of Mission Need for the Research Support Building and Infrastructure Modernization Project satisfactory and authorize DOE-SSO to proceed with CD-0.

Raymond L. Orbach, S-4
Under Secretary for Science

Date