

Stanford Linear Accelerator Center

Section 7. Infrastructure

Overview of Site Facilities and Infrastructure:

SLAC is located on 426 acres of Stanford University land, adjacent to the Stanford University campus in Palo Alto, California. Established in the 1960s, SLAC has over 1.8M square feet of space in 145 buildings. The site population is about 2,400 including staff, subcontractors, users, and visitors. SLAC’s Asset Utilization Index (AUI) is 99.9% for offices, laboratories and warehouses (excellent). The replacement value (RPV) of SLAC’s general purpose facilities is \$987M, and the “Adjusted RPV” for maintenance investment index (MII) calculation is \$617M. This “Adjusted RPV” takes into consideration SLAC’s accelerator tunnels and interaction halls, which are expensive to build but require much less maintenance than comparable office and laboratory facilities that house staff. Over half of SLAC’s RPV is composed of tunnels and interaction halls, which are in excellent condition.

The latest site master plan entitled “Stanford Linear Accelerator Center Long Range Development Plan” was last revised in June 2003 and can be found at http://www-group.slac.stanford.edu/bsd/SLAC_LRDP_final.pdf. The preparation of this plan was guided by Stanford University and it is planned to be updated in the next year to reflect the latest facilities plans at SLAC. The current land lease ends in 2012. A new long-term lease is being negotiated between DOE and Stanford University.

A table of key infrastructure data for SC facilities is shown below:

SC Infrastructure Data Summary

Replacement Plant Value (\$M)		987
Total Deferred Maintenance (\$M)		36
Asset Condition Index	Mission Critical	0.94
	Mission Dependent	0.94
	Non-Mission Dependent	0.99
Asset Utilization Index	Office	1.00
	Warehouse	1.00
	Laboratory	1.00
	Housing	0.00
Prior Year Maintenance (\$M)		12

Facilities and Infrastructure to Support Laboratory Missions:

SLAC has the six Science Mission Business Lines as discussed in the previous sections and for this section we include one site-wide operations business line. LCLS will use new and existing buildings that are currently being upgraded to Mission Readiness. SSRL will use an upgraded SPEAR Ring and some existing buildings which have a deferred maintenance backlog. A study is currently underway to explore the potential of reusing the existing PEP-II tunnels. Photon Science will need to continue to renovate Building 40 or move to a proposed new Photon Science Building in order to achieve mission readiness. The Elementary Particle Physics and Accelerator Program currently occupy parts of Buildings 40, 84, 41, and 48, and a number of trailers that are not mission-ready and are intended to be demolished. In the future, EPP will vacate Building 40 and be

consolidated into Buildings 84 and 48. Accelerator physics will be consolidated from across the site into a new Research Support building that is included in the site SLI proposal. Particle Astrophysics and Cosmology will use the new Building 51 and the newly remodeled Science Operation Center in Building 84. All six of the Business Lines described above are supported by Site-wide Operations. The underground mechanical utilities infrastructure is aging and will be replaced in phases. Elements of our Infrastructure Modernization Proposal (SLI) are focused on upgrading buildings that house essential mission support activities and are a critical part of achieving mission readiness on the site.

Facilities and Infrastructure to Support Laboratory Business Lines				
Business Lines	Facilities and Infrastructure	Summary Condition Evaluation	Planned Investments	
Linac Coherent Light Source	LCLS	Building 001 Building 002 (last 1/3) Building 009 Building 028 Building 036 Building 750 Building 910 Building 911 Building 912 Building 913 Building 920 Building 930 Building 940 Building 950 Building 960 Building 999	<ul style="list-style-type: none"> ▪ Most of the LCLS buildings are new and are in excellent condition to support this business line. ▪ Two renovations (750, 28) are included as part of the construction project to be completed in 2010 	<ul style="list-style-type: none"> ▪ Electrical equipment replacements are planned in Building 002 to improve reliability. ▪ Building 002 – Replace 12KV substation switchgears, K10 in 2009, others through 2014. ▪ Building 002 – Replace Linac VVS Transformers (GPP) VVS-10 in 2010, others through 2014.
	LCLS Undulator 2 Soft X-ray Free-Electron Laser	Building 060 Building 061 Building 136	<ul style="list-style-type: none"> ▪ Modifications will be made to Building 61 to accommodate the experiment. 	
	LCLS Undulator 3	Building 002 (first 2/3)	<ul style="list-style-type: none"> ▪ Most of the LCLS buildings are new and are in excellent condition to support this business line. 	<ul style="list-style-type: none"> ▪ Electrical equipment replacements are planned in Building 002 to improve reliability. ▪ Building 002 – Replace 12KV substation switchgears ▪ Building 002 – Replace Linac VVS Transformers (GPP)
	Injector Test Facility	Building 002 (CID)	<ul style="list-style-type: none"> ▪ Building 002 (CID) is mission ready 	

Facilities and Infrastructure to Support Laboratory Business Lines				
Business Lines		Facilities and Infrastructure	Summary Condition Evaluation	Planned Investments
Stanford Synchrotron Radiation Laboratory (SSRL)		Building 100 Building 117 Building 118 Building 120 Building 130 Building 131 Building 132 Building 137E Building 137W Building 140 Building 141 Building 219 Building 270 Building 271 Building 451 Building 452 Building 453 Building 507	<ul style="list-style-type: none"> Building 100 has been upgraded as part of the SPEAR 3 project. 	
Photon Science	Photon Ultrafast Laser Science and Engineering Center (PULSE Center)	Building 040	<ul style="list-style-type: none"> Additional lab and office space in proposed new Photon Science building. 	<ul style="list-style-type: none"> Renovation of 15,000 square feet of office and lab space in 2008 and 2009 (BES line Item).
	Stanford Institute for Materials and Energy Science (SIMES Institute)		<ul style="list-style-type: none"> Requires 20,000 square feet of lab and office space. 	<ul style="list-style-type: none"> Proposed new Photon Science Building or further renovation of Building 040
Accelerator Science		Trailer 222 Trailer 223 Trailer 229 Trailer 233 Trailer 234 NLCTA ESB (clean room) Building 006 Building 041 Klystron test lab	<ul style="list-style-type: none"> Trailers 222, 223, 229, 233 and 234 are not mission ready and need to be replaced. 	<ul style="list-style-type: none"> All Trailers will be demolished in 2011 and replaced by a new Research Support Building (SLI) to start construction in 2011.
Elementary Particle Physics		Building 048 Building 084 Building 050 Building 104 Building 121 Building 403 Building 224 Building 237	<ul style="list-style-type: none"> Building 050 has exceeded its cooling capacity Building 084, 104, 121, 237 and 224 are mission ready. Building 403 may require upgrades for earthquake standards Planned Investments: Two "Black Box" remote data centers have been installed. 	<ul style="list-style-type: none"> Renovation of laboratory space will be undertaken as part of the ATLAS upgrade project

Facilities and Infrastructure to Support Laboratory Business Lines			
Business Lines	Facilities and Infrastructure	Summary Condition Evaluation	Planned Investments
Particle Astrophysics and Cosmology	Building 051 Building 084 Building 033 Building 210	<ul style="list-style-type: none"> ▪ Building 051, Kavli Institute, is new and in excellent mission readiness ▪ Existing facilities have been remodeled to build a Science Operation Center for GLAST 	<ul style="list-style-type: none"> ▪ The existing clean room in Building 033 will require slight modification to accommodate the integration and testing of the LSST camera
Sitewide Operations	<ul style="list-style-type: none"> ▪ Electrical distribution system. ▪ Underground mechanical utilities: hot water, chilled water, cooling tower water, LCW, AIR, fire protection water, sewer drainage system, storm drainage, gas lines. ▪ Roads, Landscape and Hardscape ▪ Computing center Building 050 and black boxes ▪ Building 003 ▪ Building 024 ▪ Building 034 ▪ Building 041 	<ul style="list-style-type: none"> ▪ The electrical distribution system has been upgraded and is reliable. Roads, Landscape and Hardscape are adequate. ▪ Underground mechanical utilities are over 40 years old and are deteriorating. The hot water system leaks frequently ▪ Building 003, 024, 034, 041 are 40+ year old construction don't meet modern standards for efficiency 	<ul style="list-style-type: none"> ▪ Most of the hot water and some of the chilled water and cooling tower water underground piping will be replaced by the Safety and Operational Reliability Improvement Project. ▪ The remaining underground mechanical utilities will be replaced using IGPP funding ▪ Building 003, 024, 034, 041 will be modernized so that like functions can be consolidated

Strategic Site Investments:

In an effort to support the mission of the business lines, keep the infrastructure in operable condition and reduce deferred maintenance, many key site investments are planned in the near-term.

Current Projects

- The Linac Coherent Light Source (LCLS) project is well underway. It is currently under construction and scheduled to start operations in FY09. It will add 93,400 square feet of building area and will house the world's first X-ray free electron laser.
- The 15,000 square feet PULSE laboratories are currently under renovation and will be the main research location for PULSE in the near term. It is expected to be completed in FY09 and is the research home for LCLS research in ultrafast and high field X-ray science at SLAC and Stanford.
- The Safety and Operational Reliability Improvements (SO&RI) project is currently underway and is expected to be complete in FY09. This project includes underground utility upgrades (replacement of deteriorated sections of pipes for cooling water, chilled water and hot water) and seismic upgrades to strengthen various building structures to better assure worker safety in the event of an earthquake. These projects will contribute to the deferred maintenance reduction efforts.

Future Initiatives

Research Support Building and Infrastructure Modernization

As part of the FY10 SLI Modernization proposal, the Research Support Building and Infrastructure Modernization project was presented for funding. This project will construct a 56,000 square foot modern office building to house technical staff currently supporting the broad laboratory mission, that are dispersed throughout the site in aged trailers and other decentralized, inefficient locations. The building will meet the Guiding Principles in E.O 13423 for high performance and sustainable buildings.

This project also modernizes space (65,000 square feet) in three major buildings located in the campus area, 024 (Environmental Safety & Health), 041 (Administration) and 003 (Auxiliary Control Building). These buildings were built in the original construction of the Laboratory, are 45 years old, and have never been renovated. The modernization will bring the buildings into compliance with current building codes and the American Disabilities Act. Elevators will be installed in Buildings 024 and 041; restrooms will be modified for access compliance, etc. Energy efficient and sustainable measures will be incorporated into the new systems and components including the mechanical and electrical in accordance with the Guiding Principles of E.O. 13423.

Approximately 20,000 square feet of sub-standard trailers will be demolished to provide the footprint for the new building. These trailers average 35 years of age and greatly exceed the expected service life of 10 years. Another 37,000 square feet of trailers and a modular building will be demolished and staff relocated to the new building. SLAC is committed to modernization of the site and has started a renovation project that will consolidate the Controls Department in Building 34 and SLAC will support the funding needed for demolition of 37,000 square feet of trailers and a modular building. As part of this line item construction project, SLAC will fund the conceptual planning, design and startup costs as part of "Other Project Costs."

The Total Estimated Costs (TEC) range is \$90-\$98M. The project is planned for FY10 through FY14. The project is being conducted in accordance with the project management requirements in DOE O 413.3A and DOE M 413.3-1, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met. SLAC Deferred Maintenance (DM), as identified and reported in FIMS, will be reduced by approximately \$2M, which includes the DM of the trailers and modular building that will be removed and the DM in the three buildings to be renovated.

When assessing this project, specific screening criteria were used. The project needed to be dedicated to strong, efficient technical and business functions to support the scientific mission of the Laboratory and the mission of the Office of Science. The buildings related to the project must serve current missions and not add new programmatic scope. It could not be funded without the Initiative and was beyond the reach of IGPP funding limits. The project is also mature, specifically the project scope is well-defined and the cost and scope contingency is adequate. In addition, the project manager has been identified and is a seasoned project manager coming off of a successful turn-around of the LCLS construction. We expect that Critical Decision (CD)-0 will be completed before the end of FY08.

Research Computing Facility

A new facility will be constructed to serve Scientific Research Computing needs for both Stanford University and SLAC and will be funded by Stanford University. Four phases are proposed and each module will be constructed incrementally within 6-12 months of funding commitments with an estimated total module area of 72,000 square feet. Sustainable design principles will play a vital role in the design and operation of the facility, resulting in an efficient and low energy solution.

Facilities Renewal Plan

SLAC's future recapitalization and modernization priorities include various GPP-funded projects related to the rehabilitation and upgrade of electrical distribution system, smoke detection system, cooling and heating systems, and seismic upgrades. There are also various IGPP-funded projects related to underground mechanical utility systems, including the chilled water system, cooling tower water system, sanitary sewer system, fire protection water system, and storm drainage system. DM will be addressed with these projects.

In an effort to increase investment in infrastructure and plan effectively for future needs, a 10-year Facilities renewal plan will be developed. The approach uses building subsystem and component life cycles to general renewal curves and to estimate deferred maintenance needs by subsystem, by building, by year. This Facilities renewal plan, along with building condition inspections by vendors and in-house inspections, will guide the strategy for future Facilities building and infrastructure deferred and planned maintenance programs. The goal is to reduce the current deferred maintenance and to prevent future deferred maintenance.

Photon Science Building

While SLAC has space available for supporting R&D in areas that include accelerators and operations and maintenance, very little of it is configured for the needs of the contemporary materials, chemical and biological sciences which are central to the mission needs of the Photon Science Centers and which support and drive the science programs on LCLS and SPEAR3 (and their evolution into the future expanded/new facilities). We propose to construct an integrated Photon Science Research Building at SLAC to accommodate these growing needs. An alternate strategy will be continued renovation of existing facilities to provide these facilities.

Excess Facility Needs

Due to the close of the PEP-II run, numerous facility disposition projects have been identified. This includes BaBar Detector disassembly and BaBar Detector transportation and disposal of non-reusable components following disassembly. This D&D is being funded by OHEP.

Trends and Metrics:

There was some progress made related to the infrastructure goals in the FY07 Performance Evaluation and Management Plan (PEMP). The Laboratory achieved an MII of 1.933%, based on the approved adjusted Replacement Plant Value (RPV). This falls slightly short of the Office of Science MII goal of 2%. Deferred Maintenance (DM) reduction exceeded the planned level for FY07 although there was an increase in the overall DM backlog. Significant progress was noted in the implementation of the Computerized Maintenance Management System (CMMS). Some progress was made towards energy related initiatives and projects, DOE Order 413.3A, program and Project Management for the Acquisition of Capital Assets, and Project completion, but not at expected levels.

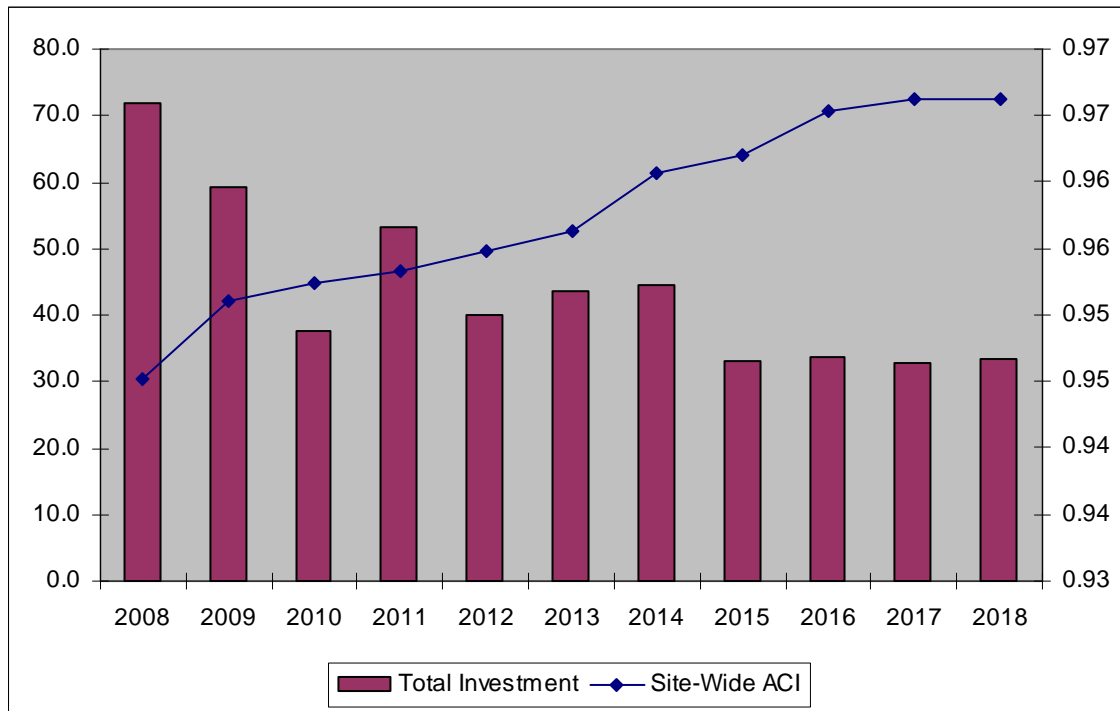
More progress related to the infrastructure goals are expected in FY08. It is expected that the DM reduction target will again be met and that the CMMS will be implemented ahead of schedule. In addition, a 10-year renewal plan for deferred and planned maintenance is currently being developed. This will guide our strategy for increasing investment in infrastructure to minimize the cost of doing business. Due to unanticipated budget reductions for FY08, it is not expected that the MII goal of 2% will be achieved. The MII is now targeted at 1.8%. The goals related to the energy related initiatives will again be challenging to meet. ESPC is currently being evaluated to help meet performance expectations.

Facilities and Infrastructure Investments (\$M) - Impact to Asset Condition Index

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Maintenance	11.7	13.0	13.1	13.2	13.8	13.7	13.9	14.8	15.8	16.0	16.5
DMR*	0.7	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Excess Facility Disposition (overhead)	0.0	0.0	0.1	0.3	0.1	0.5	0.6	0.0	0.0	0.0	0.0
IGPP	0.0	1.0	1.2	3.0	2.9	3.0	3.0	3.0	3.0	3.0	2.9
GPP	1.5	3.5	2.6	2.2	2.2	2.2	2.5	2.3	2.2	2.1	2.2
Line Items	58.2	40.7	19.2	33.2	19.7	23.0	23.1	11.5	11.5	10.5	10.5
Total Investment	72.1	59.2	37.5	53.2	40.0	43.7	44.4	32.9	33.8	32.9	33.4
Estimated RPV	617	645	660	671	687	742	754	772	789	808	826
Estimated DM	33	30	29	29	29	29	26	26	26	25	26
Site-Wide ACI	0.95	0.95	0.95	0.95	0.95	0.96	0.96	0.96	0.97	0.97	0.97

\$M's

ACI



Sustainability

SLAC is furthering its progress toward meeting the objectives of 430.2B by incorporating the Transformational Energy Action Management (TEAM) Initiative into its site goals and objectives, as demonstrated in the FY2008 Contractor Performance Evaluation and Measurement Plan. Illustrated below is a brief description of the progress made toward completing the TEAM Initiative goals and DOE Order 430.2B.

DOE Order 430.2B Goals

Requirement	Goal	Funding Source	Cost (\$K)	Milestone	Progress to Date
Energy Intensity Reduction of 30%	14%	ESPC	\$13,500	FY2015	Investigating 14% Reduction Through ESPC IDIQ
	16%	IGPP	TBD	FY2015	Metering plan, hot water piping, cold water system, duct seal pending ESPC review and decision
	TBD	SLI	TBD	TBD	TBD
Renewable Energy On-site	TBD	ESPC	TBD	TBD	TBD
	TBD	IGPP	TBD	TBD	FEMP Site Survey Scheduled
	15%	Overhead	\$10,000	FY2010	TBD - Investigating PV (ESA)
Renewable Energy Off-site	3%	Overhead	\$9.60	FY2009	Begin 5% in FY2010, increase to 7.5% in 2013
Water Intensity Reduction	16%	TBD	TBD	FY 2015	Baseline 2007
Sustainable Buildings	15% of Space	TBD	TBD	FY 2015	Building Assessment in Process

What is not apparent in this matrix are the efforts generated by SLAC to incorporate sustainability within department-level practices in adopting the Guiding Principals for Federal Leadership in High Performance and Sustainable Buildings, as set forth in the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (2006). SLAC has been moving forward toward sustainable building design by initiating its membership and training through the U.S. Green Building Council and LEED Existing Building and New Building certification processes. Additionally, SLAC continues to generate momentum toward goals in sustainability through communications, incentives, and a robust system of quarterly performance reviews. Elements of the TEAM Initiative goals are tracked and updated on a regular basis through the Environmental Management System ensuring sustainability practices are reinforced and moving forward.

SLAC's Accelerator Operations consume over 80% of the peak 65MW electrical load and without sectionalized advanced metering in place the difficulty in measuring success toward energy intensity reduction goals persist. A site-wide metering plan has been developed consistent with the Federal Energy Management Program Guidance for Electrical Metering in Federal Buildings. This plan will be initiated either through ESPC funding or IGPP funding. SLAC has completed an Initial Proposal with NORESKO in an effort to evaluate the economic feasibility of ESPC contracting.