U.S. Department of Energy
Office of Science (SC)
Stanford Site Office (SSO)
Stanford Linear Accelerator Center (SLAC)
2575 Sand Hill Road, MS-8A
Menlo Park, CA 94025

March 28, 2006

Dr. John Galayda
LCLS Project Director
Stanford Linear Accelerator Center
P.O. Box 4349, MS-18
Stanford, California 94309

Subject: Linac Coherent Light Source Critical Decision 3b Approval

Dear Dr. Galayda:

Enclosed is the decision document for Critical Decision 3b, *"Approve Start of Construction"*. Dr. James Decker approved start of construction for the Linac Coherent Light Source (LCLS) project on March 21, 2006. This milestone allows the Stanford Site Office to provide SLAC authorization to start construction of the LCLS project. The SSO will provide authorization after receiving written notification from SLAC that it is ready to exercise Phase 2 of the subcontract with Turner Construction.

I would like to congratulate you and your team on achieving this important milestone.

Sincerely,

Hanley W. Lee
LCLS Federal Project Director
Stanford Site Office

Enclosure

cc: Jonathan Dorfan, SLAC
Keith Hodgson, SLAC
Mark Reichanadter, SLAC
Jerry Jobe, SLAC
Jeff Hoy, SC-22
Nancy Sanchez, SSO
Tyndal Lindler, SSO

Critical Decision 3b, Approve Start of Construction
for the
Linac Coherent Light Source
at the Stanford Linear Accelerator Center

Office of Basic Energy Sciences
Office of Science

A. Purpose

The purpose of this paper is to document the review by the Office of Science Energy Systems Acquisition Advisory Board-equivalent for Critical Decision 3b (CD-3b), "Approve Start of Construction" for the Linac Coherent Light Source (LCLS) project at the Stanford Linear Accelerator Center (SLAC).

B. Mission Need

The mission of the Office of Science is "To advance basic research and the instruments of science that are the foundations for DOE's applied missions, a base for U.S. technology innovation, and a source of remarkable insights into our physical and biological world and the nature of matter and energy." The LCLS project is a unique opportunity for a major advance in carrying out that mission.

The LCLS ranked third in near term priorities in SC's *Facilities for the Future of Science – A Twenty Year Outlook.*

The LCLS will be the world's first x-ray free electron laser (XFEL), serving as a research and development center for XFEL physics in the hard x-ray regime and as a facility for the application of XFEL radiation to experimental science.

The LCLS will be a source of coherent x-rays with unprecedented intensity and pulse duration. It is based on the SLAC linac, which can accelerate electrons or positrons to 50 billion electron Volts (GeV). The LCLS will utilize the last third of the SLAC linac accelerating electrons up to 14 GeV.

The LCLS will be the first XFEL in the world operating in the 1.5 - 15 Å wavelength range utilizing the first harmonic of the undulator (shorter wavelengths are possible using higher harmonics). The emitted coherent x-rays will have unprecedented brightness with 10^{12} - 10^{13} photons/pulse in a 0.2 - 0.4% energy band pass and an unprecedented time structure with a design pulse length of less than 230 femtoseconds. The unique characteristics of the LCLS will open new realms of scientific applications in the chemical, materials, and biological sciences.

C. Pre-requisites for Critical Decision 3b

1. Project Execution Plan

   The Project Execution Plan (PEP) defines the roles, responsibilities and authorities for project execution. The PEP was updated to reflect the current cost and schedule baseline

and is approved as part of the CD-3b process. The PEP is ready for approval by the SC Acquisition Executive.

2. Preliminary Safety Assessment Document (PSAD)

   The PSAD documents the assessment of actions to mitigate identified hazards. The safety assessment process evaluated and developed mitigation actions during completion of title II design and was approved on January 26, 2006. The project will continue to evaluate hazards and develop controls for the operation and research activities during the development of the Final Safety Assessment Document.

3. Conventional Facilities Design and Construction

   The LCLS title II design was completed in January 2006 and the final design package was issued February 17, 2006. The project intends to release construction bid packages in three phases. The first phase bids are expected at the end of March 2006. The project awarded a contract to an experienced construction manager/general contractor that will manage the subcontract procurements and to provide general contractor services during construction.

4. Project Management Control System

   The project implemented an Earned Value Management System (EVMS) in March 2004. OECM will conduct an on-site certification review of the LCLS EVMS on March 27-31, 2006.

5. Office of Science Independent Project Review

   An Office of Science (SC) Independent Project Review (IPR) was conducted in February 2006. The purpose of the review was to evaluate project progress and to assess the readiness of the project and SLAC for construction. The IPR Committee concluded that the project made considerable progress on all fronts. SLAC management is very supportive and highly engaged in the LCLS project. The Committee also concluded that the construction manager/general contractor appeared to be capable of managing the conventional construction. The overall cost estimates and contingency are considered reasonable. The Committee recommended that DOE proceed with approval of CD-3b.

D. Project Scope Baseline

The scope baseline of the LCLS project consists of a 135 MeV injector to be built at Sector 20 of the 30-sector SLAC linac to create the electron beam required for the XFEL. Portions of the last one-third of the linac will be modified by adding two magnetic bunch compressors. Most of the linac and its infrastructure will remain unchanged. The existing components in the Final Focus Test Beam tunnel will be removed and will be replaced with a Beam Transfer Hall (BTH). An Undulator Hall (UH) tunnel and associated equipment will be installed after the BTH. Two new below grade experimental halls will be constructed. The Near Experiment Hall (NEH) and the Far Experiment Hall (FEH) will be built approximately 70 meters and 400 meters downstream of the UH, respectively. The NEH and the FEH will be connected by an x-ray transport tunnel. A Central Laboratory and Office building will be constructed at the NEH site.

E. Project Cost and Schedule Baseline

The baseline budget authority (BA) funding requirements for the LCLS project are reflected in the FY2007 Construction Project Data Sheet and are shown below. The Total Estimated Cost (TEC) baseline is $315.0 million. Other Project Costs (OPC) total $64.0 million. The Total Project Cost (TPC) baseline is $379.0 million. The cost and schedule baseline is based on receiving the following BA funding profile.

Linac Coherent Light Source BA Funding Profile ($M)									
	FY02	**FY03**	**FY04**	**FY05**	**FY06**	**FY07**	**FY08**	**FY09**	**Total**
TEC	0	5.93	7.46	49.67[1]	84.69	105.90	51.35	10.00	315.00
OPC	1.50	0	2.00	4.00	3.50	16.00	15.50	21.50	64.00
TPC	1.50	5.93	9.46	53.67	88.19	121.90	66.85	31.50	379.00

[1] *FY2005 TEC funding includes $29,760,000 for long lead procurements.*

The schedule baseline is as follows:

CD-0	Approve Mission Need	June 2001 (A)
CD-1	Approve Preliminary Baseline Range	October 2002 (A)
CD-2a	Approve Long-Lead Procurement Budget	July 2003 (A)
CD-2b	Approve Performance Baseline	April 2005 (A)
CD-3a	Approve Start of Long-Lead Procurements	December 2004 (A)
CD-3b	Approve Start of Construction	March 2006
CD-4	Approve Start of Operations	March 2009

Note: (A) indicates actual milestone completion date.

F. Environmental Strategy

The LCLS will be designed, constructed and operated in compliance with all requirements of the National Environmental Policy Act (NEPA) and its implementing regulations. Design, construction and operation activities have been evaluated in the NEPA Environmental Assessment (EA1426) for the LCLS Project. A Finding of No Significant Impact was issued on February 28, 2003.

Submitted by:

Hanley W. Lee — 3/3/06

Hanley W. Lee
Federal Project Director
Stanford Site Office

Date

Nancy N. Sanchez — 3/6/06

Nancy N. Sanchez
Director
Stanford Site Office

Date

Jeffrey C. Hoy — 3/17/06

Jeffrey C. Hoy
LCLS Program Manager
Office of Basic Energy Sciences
Office of Science

Date

Patricia M. Dehmer — 3/17/2006

Patricia M. Dehmer
Director
Office of Basic Energy Sciences
Office of Science

Date

Recommendations

The undersigned "Do Recommend" (Yes) or "Do Not Recommend" (No) approval of CD-3b, *Approve Start of Construction*, for the Linac Coherent Light Source at SLAC as noted below.

ESAAB Secretariat, Office of Project Assessment	3/17/06 Date	Yes ✓	No ___
Representative, Non-Proponent SC Program Office	3/17/06 Date	Yes ✓	No ___
Representative, Office of Budget and Planning	3/17/06 Date	Yes ✓	No ___
Representative, Environment, Safety and Health Division	Date	Yes ___	No ___
Representative, Security Management Team	3-14-06 Date	Yes ✓	No ___
Representative, Infrastructure Division	3-17-06 Date	Yes ✓	No ___
Representative, Grants and Contracts Division	Date	Yes ___	No ___