Critical Decision 3a, Approve Start of Long-Lead Procurement
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 CD-3a, "Approve Start of Long-Lead Procurement" 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 Linac Coherent Light Source (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-radiation 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 bandpass 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 Decisions 3a

1. Acquisition Execution Plan

   The Acquisition Execution Plan was approved by the Under Secretary on October 16, 2002. The acquisition of the LCLS will be conducted through the existing Management and Operating contract with Stanford University. SLAC will execute those parts of the

project associated with conventional facilities and the acceleration and control of the electrons as well as overall system integration and management. The Advanced Photon Source Division at ANL will design and fabricate the undulator and associated systems. The Physics and Advanced Technologies Directorate at LLNL will design, fabricate, qualify, and commission the front-end x-ray optics.

Project activities, which include the long-lead procurements, will be accomplished to the extent feasible using fixed-priced subcontractors competitively selected by SLAC and the collaborating laboratories on the basis of best value, price and other factors.

2. Preliminary Safety Assessment Document (PSAD)

   A preliminary hazard analysis for the LCLS facility was conducted in June 2002. It identified hazards associated with the design, fabrication, construction, and testing phases the project. The assessment concluded that the LCLS is within the existing safety and operating envelopes, the risks of all hazards will be similar in nature and magnitude to those already found in the present accelerator and synchrotron radiation programs, and the hazard impact will have only the potential for minor on-site and negligible off-site impacts to people or the environment. The PSAD will continue to evaluate hazards and mitigative actions and will be approved prior to start of construction. 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. External Independent Review

   An External Independent Review (EIR) of the project was conducted by the Office of Engineering and Construction Management (OECM). OECM contracted with Burns and Roe Enterprises, Inc. to perform the review of the LCLS project in June 2004. A final report was issued August 2004. The project has submitted a corrective action plan to address the recommendations of the EIR team. There were no EIR issues that would preclude proceeding with long-lead procurements.

4. Project Management Control System

   An Earned Value Management System (EVMS) was implemented for the LCLS project in March 2004. The system was reviewed by the External Independent Review team in June 2004 and concluded the system satisfies established requirements. OECM will evaluate the EVMS for certification in 2005.

5. Office of Science Independent Project Review

   An Office of Science Independent Project Review was conducted in August 2004. The purpose of the review was to evaluate the project baseline and long-lead procurement readiness. Concerning the long-lead procurements, the Committee concluded that their scope, cost and schedule were reasonable. In addition, the Injector, Linac and Undulator Systems designs were judged to be mature and the Committee recommended that the long-lead procurements should proceed.

D. Long Lead Procurement Scope and Cost

The long-lead procurement (LLP) scope includes items from the Injector, Linac and Undulator Systems.

Injector System

Drive Laser
Streak Camera
System equipment and components
Sector 20 Injector Facility

Total Injector System LLP Cost $16.3M

Linac System

BC1 Magnets
BC2 Magnets
RF X-band

Total Linac System LLP Cost $1.6M

Undulator System

Titanium Strongbacks
Magnet Blocks
Magnet Poles
Magnetic Measurement System

Total Undulator System LLP Cost $6.0M

FY 2005 budget for LLP is $30.0M and the total LLP cost is estimated to be $23.8M. Contingency for LLP is $6.2M or 26%.

G. 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:

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12/9/04
Date

for
John S. Muhlestein
Director
Stanford Site Office

12/10/04
Date

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Date

Patricia M. Dehmer
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Director
Office of Basic Energy Sciences
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10 December 2004
Date

Recommendations

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

12/10/04 Yes ✓ No____
ESAAB Secretariat, Office of Major Systems Assessment Date

Shawn J Long 12/10/04 Yes____ No____
Representative, Non-Proponent SC Program Office Date

12/10/04 Yes ✓ No____
Representative, Financial Management Division Date

12/10/04 Yes ✓ No____
Representative, Environmental, Safety and Health Division Date

12/10/04 Yes ✓ No____
Representative, Security Management. Team Date

12/10/04 Yes ✓ No____
Representative, Laboratory Infrastructure Division Date

Yes____ No____
Representative, Grants and Contracts Division Date

Approval

Based on the material presented above and at this review, Critical Decision-3a, Start of Long-Lead Procurement, is approved. Therefore, the Office of Basic Energy Sciences may authorize expenditure of FY 2005 Long-Lead Procurement funds for the Linac Coherent Light Source at the Stanford Linear Accelerator Center.

James F. Decker
Director
Office of Science

12/10/04
Date