

# memorandum

DATE: December 18, 2006

Report Number: OAS-L-07-04

REPLY TO

ATTN OF: IG-32 (A07LL039)

SUBJECT: Report on "Inquiry to the Hotline Complaint on Possible Design Mistakes and Cost Overruns of the Linac Coherent Light Source Project at Stanford Linear Accelerator Center"

TO: Manager, Stanford Site Office

## INTRODUCTION AND OBJECTIVE

The purpose of the Stanford Linear Accelerator Center (SLAC) Linac Coherent Light Source (LCLS) project is to provide laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak brightness than any existing coherent x-ray light source. The LCLS will be an important tool in the study of, among other things, materials structure at the nanoscale. The total estimated cost for the LCLS project is \$315 million (\$36 million for design and \$279 million for construction, equipment, and site preparation).

SLAC awarded a firm fixed-priced contract for the design of the site and the facilities that will house the equipment, researchers, and support personnel. Based on design drawings, SLAC issued a request for bids on the construction phase of the project. SLAC subsequently awarded several firm fixed-price contracts to start preparing the site and building the facilities. Site preparation started in October 2006; construction of the facilities is scheduled to begin in February 2007.

On September 5, 2006, the Office of Inspector General received a Hotline complaint alleging design mistakes and cost overruns on the LCLS project. The complainant alleged that the LCLS project's design plans were not structurally sound in that there were mistakes on the seismic load of the conventional facilities, and a drainage system had not been designed for a portion of the project. The complainant further stated that these issues were brought to management's attention in February 2006 and that SLAC management was not responsive. In a subsequent discussion, the complainant also alleged that the project cost had dramatically increased from \$80 million to \$120 million resulting in a \$40 million cost overrun.

Due to the potential safety implications of the complaint, we initiated an inquiry to determine if SLAC management took appropriate action to address the allegations.

## CONCLUSIONS AND OBSERVATIONS

SLAC management, including the LCLS project management team, initiated a peer review and an internal project review to address the allegations relevant to the facility design. Based on these reviews, SLAC officials concluded that the basic design was structurally sound. Also, based on our discussions with SLAC and Stanford Site Office officials, along

with our review of procurement documents, we concluded that the alleged \$40 million cost overrun was overstated and resulted from the difference between the Government's independent cost estimate and the updated estimate based on actual cost data received from the bid results.

### Facilities Design

SLAC management took prompt action to address allegations about the soundness of the facilities design. Specifically, the SLAC LCLS project management team initiated an internal review of the design after being notified by the complainant about possible design errors in February 2006. Additionally, the SLAC Director established a peer review team composed of representatives from his office and an outside structural engineering firm to address the allegations, one week after being informed by the complainant on April 30, 2006. As part of the peer review team effort, the structural engineering firm employed a geotechnical firm to independently review previous geotechnical work that was used to design the LCLS site and facilities. In conducting its review, the structural engineering firm also consulted with seismic and building consultants from the University of California, Berkeley Campus and used the Bay Area Rapid Transit system as the model during the consultation.

Management informed us that the two review teams concluded that the basic design of the site and the facilities was structurally sound. Further, the structural engineering firm agreed with the protocols and procedures used in developing the LCLS design. However, the structural engineering firm was unable to conclude at what level of seismic activity the facilities would structurally fail since there were no specific building codes for an underground structure such as the LCLS project. Therefore, engineering judgment was a factor in determining the level of design and construction that would be adequate in building an underground structure to meet seismic activities for the region. With regard to the drainage system, both the structural engineering firm and the SLAC LCLS management team concluded that the drainage system had been included in the design, although it could have been better highlighted in the design drawings.

SLAC plans to direct some design improvements to maintain a more conservative position on the soundness of the LCLS facilities. Specifically, SLAC has directed that design changes be made for:

- Additional strengthening at specific locations where columns and beams join together;
- Other seismic improvements as suggested by the peer review; and,
- Additional drainage improvements.

Because these additional improvements could not be shown as design defects, but rather as enhancements requested by SLAC, the project will absorb the cost of changes to the design contract.

The Director stressed that the complainant was kept informed on the progress of the peer review, but had also been informed that he needed to let the review process be completed.

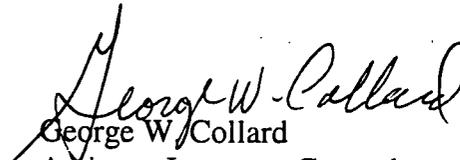
Cost Estimates

Regarding the alleged \$40 million cost overrun, our inquiry indicated that the increase in the project cost was about \$25 million and was due to the difference between the Government's independent cost estimate for the construction phase of the project compared to the actual cost data from bids received from construction and supply firms. Management informed us that the independent cost estimate was based at the 100 percent design stage and was developed based on estimates provided by the design firm, the construction general contractor, a company that performs tunneling work, and a company that performs above ground construction. The Government developed an independent cost estimate of \$75 million based on the four estimates. However, once the bids were received, the actual costs were higher than estimated. Based on actual cost data, SLAC's revised estimate increased the construction cost to \$100.5 million. A determination by SLAC found that the basis for the disparity was that market conditions had changed significantly for the region. Their review found that the project was competing for building materials (such as steel and concrete). Further, construction demand in the region was greater than the available supply of builders and suppliers, and there was also a low turnout in response to the request for bids.

The Stanford Site Office LCLS project manager was informed by the SLAC LCLS project management team of the seismic and drainage issues when the complainant brought his concerns to their attention in February 2006. Your office was also aware of the additional construction costs above the Government's independent cost estimate and, with SLAC, is currently looking at options to address this funding shortfall.

Given planned management actions to address the design and cost issues, we are not making recommendations at this time. However, we plan to follow-up on the resolution of these issues during our annual risk assessment of SLAC, in February 2007. Accordingly, no response is necessary to this report.

We thank you and your staff, as well as SLAC management, for the cooperation received during this inquiry.

  
George W. Collard  
Assistant Inspector General  
for Performance Audits  
Office of Inspector General

cc: Chief of Staff  
Audit Liaison, Office of Science, SC-32.1  
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