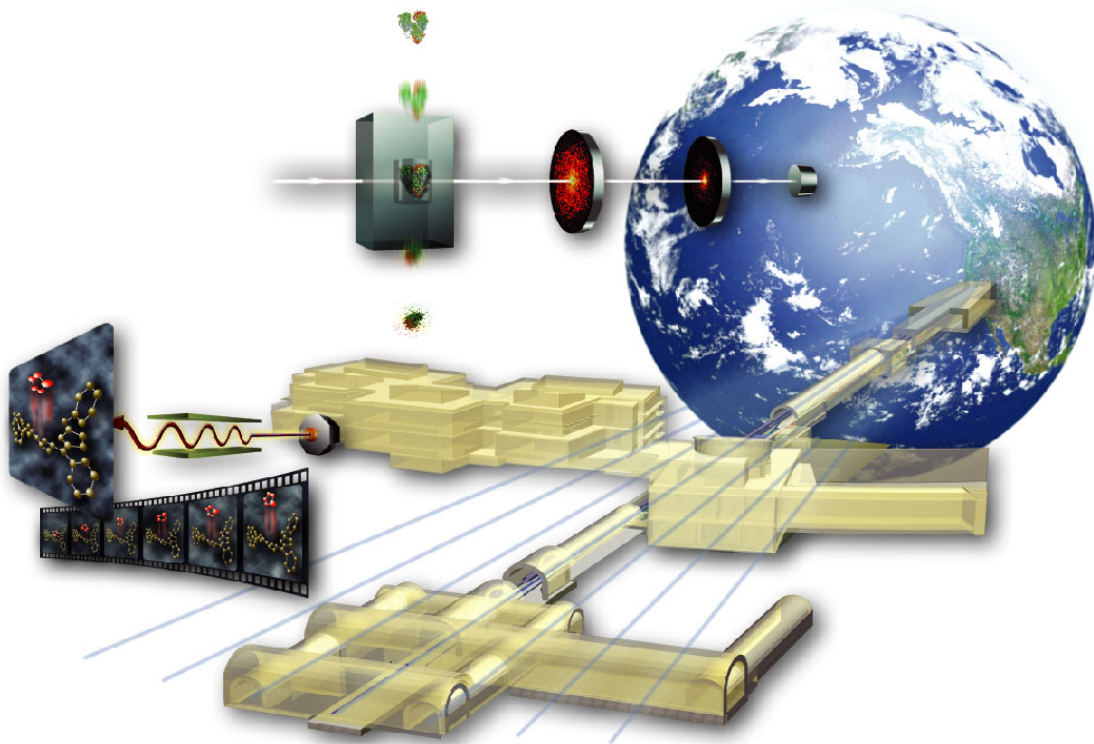


Monthly Report

September 2006



CONTENTS

PROJECT OVERVIEW AND ASSESSMENT	3
TECHNICAL AND PROGRAMMATIC PROGRESS	
<u>LCLS Project Office & Support</u>	
WBS 1.1, 2.1 Project Planning, Management & Administration	4
<u>Electron Beam Systems</u>	
WBS 1.1.3, 1.X.3 Global Controls	6
WBS 1.2, 2.2 Injector	7
WBS 1.3, 2.3 Linac	8
WBS 1.4, 2.4 Undulator	9
<u>Photon Beam Systems</u>	
WBS 1.5, 2.5 X-Ray Transport & Diagnostics	10
WBS 1.6, 2.6 X-Ray Endstations	12
<u>Conventional Facilities</u>	
WBS 1.9, 2.9 Conventional Facilities	13
COST PERFORMANCE REPORT	
-Cost/Schedule Variance Narrative	15
-Change Control Activity	
-Milestone Performance	
GLOSSARY	19

Project Overview and Assessment

Highlights:

- The CF group has updated its Estimate to Complete (ETC) and presented it to the LCLS Change Control Board for approval. BCR CF-55 provides the details of the updated ETC which resulted in an increase to the CF estimated base cost of \$4,526K.
- The construction phase for the LCLS major civil activities began with the on-site mobilization of heavy equipment on Sept 09, 2006. This work is being managed by the Turner Construction (TCCo). To date, construction is ~1% complete. Field Change Orders to date are ~6.5% of work accomplished.
- As reported last month, Injector installation (with emphasis on the Injector components in the SLAC Linac enclosure) remains the top priority.
 - Late delivery of several Injector and Linac component has necessitated re-optimizing the installation schedule to accommodate delivery variations. Monitoring of component delivery will continue in order to assure completion of the down activities.
 - Insertion/SAB X and Y chambers, GTL instruments, laser barrier wall and vault water are all high risk schedule items.

Assessment and Issues:

- The September 2006 Cost Performance Report (CPR) is the 31st month of reporting earned-value on the LCLS TPC. For this month the LCLS cost and schedule indices are 0.96 and 0.97, respectively. Total obligations to date (actual costs + open commitments) are \$141,296K.
- With all Bid Group #2 bids known, CF has updated its cost estimate to reflect the lowest bidder in each bid package. This has resulted in an increase to the CF cost estimate of \$6,213K. The CF scope of work is now entirely based upon competitive firm-fixed pricing from the market rather than the constructor's estimates.
- The large CF variances between the constructor's cost estimate and bid proposals are primarily driven by higher than anticipated material prices (steel, concrete) and unusually high market demand in the San Francisco Bay Area. To reduce the draw upon project contingency, LCLS management has decided to support LCLS operations through renovation of existing lab space at SLAC rather than new construction (CLOC building). This decision will be reviewed in the next Office of Science Independent Project Review scheduled for October.

Project Office and Support

WBS 1.1, 2.1 Project Planning, Management and Administration

Highlights:

- LCLS Information Technology Status – September 2006.
 - Beamline Optics Files – A comparison program has been put into production which allows easy comparisons of different versions of the optics files to be displayed.
 - Cabling Database – Developed draft version of a database application that incorporates cabling data with optics and non-optics configurations. It allows easy integration of changes from new versions of the optics file.
 - Computers and Badging Setup – Computers will be setup in the TCCo intake trailer for data entry and contractor badge photos and a shared badging printer. Testing is being done with the equipment to ensure readiness when the trailer arrives.

- LCLS Environmental, Safety & Health Status – September 2006.
 - Through the end of September, LCLS worked 136 days without a recordable injury. Prior to an injury reported in May 2006, the project worked 235 injury free days. The LCLS project recordable incident rate is currently 0.54¹, which compares favorably to general industry rates of 6.8 and that of the Department of Energy which is 2.1 for similar work.
 - Fire Hazards Analysis - SLAC released the final draft of the Fire Hazards Analysis (FHA) for internal and DOE review and comments in late June. DOE has provided comments back which the SLAC Deputy Fire Marshal is developing responses and will then incorporate those details in the FHA. The revised FHA was delivered to LCLS, and is preparation for DOE/SSO acceptance by month end of October.
 - Contracted work – During September Turner Construction Company (TCCo) began mobilizations for project construction. In addition, final demolition of buildings was completed. The demolition work was completed without personnel injuries [as was the mobilization].
 - Training Compliance - LCLS compliance for employee mandatory training is currently at 91% which is above the SLAC goal of 90%. Compliance to SLAC's Training Assessment (STA's) is currently 98%; above the SLAC goal of 90%.
 - Tunnel Rescue - TCCo's tunneling subcontractor, Affholder, has stated that they will not have more than 12 individuals working underground at any single point in time. This means that there will only be a need for single emergency response team. Affholder has made contact with the Palo Alto Fire Department to discuss support services. Affholder has

¹ The number of injuries sustained by an average work crew of 100 individuals over a year.

stated that they will make available their emergency response trailer and equipment to the Fire Department.

- LCLS Procurement Status – September 2006
 - The LCLS Procurement Department continued with heavy activity in September, mainly due to issues arising with Jacobs and Turner subcontracts as the LCLS project enters Phase 2 and the primary construction effort begins.
 - A/E Design – Planning for Value Engineering issues has continued with Jacobs Engineering. A great deal of effort has been put forth to examine ways to reduce cost without compromising design. The VE effort has continued into September and SLAC received a proposal from Jacobs to finalize negotiations on this effort. A mod has been issued with signatures expected to be received in October.
 - CM/GC – Settlement on contract modifications 10, 11, and 12 was completed in September. These modifications covered settling the payment of bond costs, administrative changes (key personnel etc.), and implementation of the field change order process.
 - LTU Quadrupoles – Subcontract awarded with April 2007 due date.
 - Injector Quadrupoles – Subcontract awarded. All critical items have been received. One remaining item (non-critical) will ship in December.
 - Controls and Power Supply Racks – Subcontract awarded. All but 2 were received in April with the remaining 2 delayed because of problems getting heat-sinks from their supplier. The heat-sink problem was resolved in June resulting in delivery in October.

Assessment and Issues:

- LCLS issued a deficiency notice to Turner Construction on September 19 to stop subcontractor construction activities because of several minor safety infractions identified by the project (UTR and Safety Officer). The infractions did not involve any injuries but the project acted on these indicators to prevent injuries when construction activities increased. Turner's response was constructive and a corrective action plan was implemented. Normal construction activities were resumed in approximately five days.

Electron Beam Systems

WBS 1.1, 1.x.2 Controls System

- Management and Safety –
 - The Final Design Review for the LLRF system was held with only minor suggested changes. The Phase and Amplitude Detector (PAD) software is completed. PAD tests of SNR and crosstalk were performed. The PAD RF head prototype is near completion. Two pre-production PAD boards are digitizing waveforms at 30MHz and seem to be functional. Parts for PAC RF heads have been received and we will assemble a pre-production unit next month.
- Laser Controls – All imaging equipment for the Laser launch system, including cameras, camera breakout boxes, interface modules and cables, were received, tested and are ready to install. Auxiliary equipment including the 30-meter motion cable, UPS, function generators and Surveillance cameras, the Power meter and the Solenoid controller for filters were received, tested and are ready to install.
- Injector and Linac Controls Installation –
 - Phase II installation of the cable plant started in the injector and linac areas. All electronics racks were moved from building 24 to the linac gallery and completed the installation of the racks
 - 4 of 7 wire scanners have been calibrated and tested, and two of those are installed. The automated calibration procedure allows scanner set-up and calibrate times in about 1.5 hours. Most vacuum hardware is in the racks in sector 20.
 - Valve controllers are under fabrication and ready by end of October. PLC crates and network hardware and cables have been received. EPICS support for pump controller and gauge controllers is done.
 - All magnet power supply racks have been fully loaded, tested and installed in the linac gallery. The software for magnet standardization was completed and tested. The SLC-aware IOC for feedback control and standardization was tested.

Assessment and Issues:

- The installation schedule for the 2006 down is very tight. The cable plant contract is critical path. Controls component checkout at the end of the down is at risk.

WBS 1.2, 2.2 Injector System

Highlights:

- Drive Laser - The Swamp Optics FROG was installed and temporal shaping of the Injector Drive Laser was attempted.
- Injector Installation –
 - Installation work continues with removal of Accelerator S-Band and disk-loaded waveguides. Installation of S-Band waveguide started in the Linac Klystron Gallery for powering the RF Gun and LOA&B.
 - The RF Gun was baked; gun hot test will follow post-bake assembly.
 - The dual feed structure LOA was tested for straightness and required straightening to reduce electron beam emittance growth in the structure. Following straightening, the LOA structure went to integration assembly with the LOA solenoid. The LOB structure started bake.
 - Insertion/SAB support stand due date was adjusted to match the installation schedule which will allow time for the stands to be painted prior to delivery.
 - Injector Vault laser wall design requirements were received from the laser safety committee and laser safety officer.
 - The first phase of vault water piping is underway. Further contracts are required for pump-pad modification and water system controls.

Assessment and Issues:

- As reported last month, Injector installation (with emphasis on the Injector components in the SLAC Linac enclosure) remains the top priority.
 - Late delivery of several Injector and Linac component has necessitated re-optimizing the installation schedule to accommodate delivery variations. Monitoring of component delivery will continue in order to assure completion of the down activities. Assessment of completion success will be made continually through the down. Twice weekly beamline integration status and planning meetings have been instituted to prioritize shop work and facilitate installation activities.
 - High schedule risk components for 2006 installation remain: Insertion/SAB X and Y chambers, GTL instruments, laser barrier wall and vault water are all high risk schedule items.
- Discussions with the vendor concerning the failure of the ceramic braze on the Injector and Linac Toroids resulted in changing the braze process to standard metallizing and metallic brazing. New brazed ceramics are due by the first week in October. The brazed ceramic assemblies will be internally coated at SLAC then returned to the vendor for final assembly.

WBS 1.3, 2.3 Linac System

Highlights:

- LCLS Linac Design Effort –
 - Design work was started on L2, BC2, LTU and E-Dump. LTU and E-Dump design teams are requesting verification of Conventional Facilities enclosure placement with respect to LCLS coordinates. CF Release-For-Construction drawings will be rendered in Solid Edge to provide internal enclosure location to design teams.
 - Linac to CF interface meetings are being held to resolve issues with BTH West water and power as well as BTH support building power requirements and PPS entry requirements.

- Linac Installation –
 - The 9.5 foot accelerator sections for L1 completed bake and were measured for straightness prior to transport to Linac Sector 21 for installation.
 - The BC1 dipoles were fiducialized and magnetically measured. Field tolerances were within specifications.
 - Linac vacuum header modifications were completed which allows installation of the BC1 Chicane table. X-Band structure installation was completed.

Assessment and Issues:

- High schedule risk components for 2006 installation are: BC1 Collimator COL11 and Bunch Length Monitor BL11. The BL 12 bunch length monitor will be installed and used for commissioning.

WBS 1.4, 2.4 Undulator System

Highlights:

- Management and Safety – Final design reviews for the support mover system, and beam finder wire system were held and were successful.
- Undulators and Undulator Assemblies – Six additional undulator assemblies have been completed. Delivery to SLAC is being held until a few more are complete to save shipping costs.
- Beam Position Monitors – The testing of the 1st beam position monitor prototype has been completed and we are now looking forward to making small changes and placing the order for the 3 prototypes to be used in the 3 BPM test.

Assessments and Issues:

- Quadrupoles –
 - The stability of the quadrupole magnetic center is a concern. Soft magnetic material will be used to minimize the impact. ANL magnet experts are working closely with the vendor on material selection to minimize the effect.
 - Quadrupole deliveries are driving the undulator assembly process. ANL is working with the vendor to shorten production as much as possible.
- Vacuum Chamber –
 - The prototype vacuum chamber (4-weld) is significantly behind schedule due to delays at the vendor facility. The ANL group is reconsidering its commitments with this vendor. Although the chamber is not on the critical path this could change if the delay extends. Presently the chamber production is only 20 days from impacting the assembly.
 - LCLS management has begun to develop an alternative undulator vacuum chamber (clamshell) design to reduce technical and schedule risks. A final design decision is tentatively schedule for January 2007.
- Magnetic Measurement Facility –
 - The MMF temperature control was out of specification for most of the month due to a faulty valve. Once the valve was replaced, the temperature control came into specification.
 - The MMF Setup, WBS 1.4.3.6.1 continues to run behind schedule and over budget. The latest estimate is that the first undulator may be ready for the tunnel in 2 months with 5 FTE's for those 2 months.
 - The delivery of the mu-metal shielding and phase shims are impacting the work in the MMF.

Photon Beam Systems

WBS 1.5, 2.5 X-ray Transport, Optics & Diagnostics (XTOD)

Highlights:

- Management and Safety – The draft FY07 MOU Technical Addendum, “Appendix G,” between SLAC and LLNL was completed and is now in signature. The XTOD milestones have been revised to be consistent with the last BCR. The XTOD scientists and engineers have been directed to prepare for the FAC and Lehman reviews to be held in October. The Solid Attenuator Integrated (Safety) Worksheet Sheet (IWS) has been reviewed. The IWS for the primary XTOD development laboratory and Gas Detector are ready for approval.
- Slit / Fixed Mask / Fast Valve – Work on the final design for the slit continues. The figure shows the latest details for the slit block positioning system. A draft ESD for the Slit has been written as a stand-alone document.
- TTF Damage Experiment –
 - The second TTF damage experiment, at the FLASH facility in DESY Hamburg, received beam in September. The samples included 1) Sputtered B₄C on Si, as envisioned for the low-energy Offset Mirrors, 2) Bulk and sputtered SiC, 3) Ce:YAG scintillator, and 4) two samples of diamond (a potential scintillator). Data was taken at FEL wavelengths of 32 nm, 21.7 nm and 13.5 nm. The exposed samples, upon preliminary examination with the on-chamber microscope, showed the expected damage threshold. Further analysis should allow this data set to determine the damage threshold with better precision, as the pulse energy measurements are better this time.
 - The Ce:YAG exhibited the expected scintillator characteristics. Recorded spectra were very similar to that reported in the literature and obtained with hard X-ray excitation. Saturation was observed at 13.5 nm, similar to the saturation at 100 nm measured in the previous test at TTF1. This “predictability” makes YAG the scintillator candidate of choice for the LCLS Direct Imager.
- Modeling and Simulation – A worst-case scenario for the 10-year radiation dose to an elastomer o-ring located near the X-ray beam in the FEE has been computed. A low Z solid (Be, SiC, or Si) was placed in the beam at 45 degrees directly below the assembly. The solid was hit with the high-energy spontaneous beam and the Compton scattered photons were tracked through the assembly and the energy deposition in the o-ring was tallied. After the equivalent of 10 years of LCLS running, the o-ring dose was between 0.4 MRads and 10 MRads (67% confidence interval). Viton brand elastomer is rated at 10 MRads, even in this

extreme configuration the analysis indicates little or no significant radiation damage for at least 10 years.

- Direct Imager – Tradeoffs presented by various camera/lens combinations available from vendors are being evaluated (see above.) A test stand for the Direct Imager that uses a pulsed N₂ laser to excite the YAG has been designed. Orders have been placed for the test stand source and optics.
- Controls – The XTOD temperature measurement requirements were gathered to consolidate and organize the XTOD temperature measurement controls. The EPICS naming was revised to accommodate SLAC's database constraints, operations needs, and the "split" beamlines in XTOD. The revised structure also breaks out the XES, Fast Shutter, Flipper Mirror and other deferred items without throwing away planning details. All XVTS electrical drawings are now complete, in preparation for the XTVS Final Design Review.

Assessment and Issues:

- None.

WBS 1.6, 2.6 X-Ray Endstation Systems

Highlights:

- Management & Safety –
 - The XES group presented a Baseline Change Request (BCR) for controls installation costs which had not been included in the previous ETC process. The BCR was approved by the LCLS CCB. A detailed commissioning schedule is still being developed at the detail level, which will address the issue of staffing mentioned below in the “Assessment and Issues” paragraph.
 - The XES is working closely with SLAC’s Radiation Physics Group defining the requirements for the stoppers of the Personal Protection Systems (PPS) which will eventually evolve into a Physics Requirement Document.
- LCLS Detector Project – Cornell University is on schedule with the planned submission of a third prototype chip in the beginning of October. The XES group is updating the Physics Requirement Document (PRD), the Engineering Specifications Document (ESD) along with an Interface Controls Document (ICD) between LCLS and the Bio Imaging experiment of the LUSI project.
- AMO Instrument – A narrative description of the AMO instrumentation requirements has been completed and will serve as the basis for the PRD for the instrument. A conceptual design review is planned for November. Electrostatic modeling calculations for the overall electrostatic design and AMO electron time-of-flight spectrometers have been completed. The AMO team is coordinating their laser requirements with the LCLS laser group. Currently, pulse energy of at least 10 mJ is considered the preferable to OPA capabilities. Discussions are also ongoing evaluating the scientific capabilities of the refocusing optics for investigating high field phenomena.
- XES Controls – The XES Controls has started with the conceptual design of the AMO experimental controls. A design document is being drafted.

Assessment and Issues:

- Commissioning – The long-range staffing plan is continuing to be developed, particularly the transition from commissioning staffing levels to an adequate level for operating the LCLS.

Conventional Facilities (CF)

WBS 1.9, 2.9 Conventional Facilities (CF)

Highlights:

- Management & Safety – The CF group has updated its Estimate to Complete (ETC) and presented it to the LCLS Change Control Board for approval. BCR CF-55 provides the details of the updated ETC which resulted in an increase to the CF estimated base cost of \$4,526K.
- Construction Progress – The construction phase for the LCLS major civil activities began with the on-site mobilization of heavy equipment on Sept 09, 2006. This work is being managed by the Turner Construction (TCCo). Other related highlights are;
 - SLAC implemented preparations for the start of the major construction activities. Pep Ring road has been closed off to routine traffic, Alpine Gate has been restricted to construction traffic only, and Gate 17 is now manned by SLAC Security around the clock.
 - The TCCo construction scope was ~1% complete for the end of the month. Field Change Orders to date are ~6.5% of work accomplished.
 - The construction project schedule was approved by the Project and reflects a favorable beam-path schedule of 18 months.
- Commenced construction for Building #102 Seismic Upgrade Retrofit. This effort is managed directly by the CF group and is scheduled to be complete in November.

Issues and Assessments

- The large CF variances between the constructor's cost estimate and bid proposals are primarily driven by higher than anticipated material prices (steel, concrete) and unusually high market demand in the San Francisco Bay Area. To reduce the draw upon project contingency, LCLS management has decided to support LCLS operations through renovation of existing lab space at SLAC rather than new construction (CLOC building). This decision will be reviewed in the next Office of Science Independent Project Review scheduled for October.
- With all Bid Group #2 bids known, CF has updated its cost estimate to reflect the lowest bidder in each bid package. This has resulted in an increase to the CF cost estimate of \$6,213K. The CF scope of work is now entirely based upon competitive firm-fixed pricing from the market rather than the constructor's estimates.

- Bid Group #2 Certification letters from TCCo have been slower than planned. TCCo has received an extension from the original expiration date to November 15, 2006 for all Bid Group #2 bidders. Late award of the remaining bid packages are not expected to have a schedule impact if bids are awarded by November 15, 2006.



LCLS Cost and Schedule Performance – September 2006

LCLS Cost/Schedule Status Report - Work Breakdown Structure										30-Sep-06
WBS	Cumulative to Date (\$K)							At Completion (\$K)		
	Budgeted Cost		Actual Cost Work Performed	Variance		Performance Indices		Budgeted	Management Estimate at Complete*	Variance
	Work Scheduled	Work Performed		Schedule	Cost	SPI	CPI			
1.1 Project Management	18,355	18,008	20,118	-347	-2,110	0.98	0.90	25,391	27,771	2,380
1.2 Injector	18,262	17,448	19,431	-814	-1,983	0.96	0.90	20,466	22,751	2,285
1.3 Linac	10,105	9,607	9,425	-498	182	0.95	1.02	27,169	26,594	-575
1.4 Undulator	19,745	19,009	20,167	-736	-1,159	0.96	0.94	40,597	41,756	1,159
1.5 X-ray Transport	10,102	9,860	10,294	-242	-433	0.98	0.96	24,604	25,037	433
1.6 X-ray Endstations	1,560	1,350	1,368	-210	-18	0.87	0.99	15,358	17,354	1,997
1.9 Conventional Facilities	24,382	24,223	24,094	-159	129	0.99	1.01	123,982	122,014	-1,968
1 LCLS Total Base Cost	102,512	99,505	104,897	-3,007	-5,392	0.97	0.95	277,566	283,277	5,711
								LCLS Total Estimated Cost	315,000	315,000
								Avail. Contingency	37,434	31,723
								% Contingency / ETC	21.0%	17.3%
								% Complete LCLS Base Cost	35.8%	35.1%
2.1 LCLS Project Mgmt, Planning & Admn (OPC)	6,671	6,636	6,671	-35	-36	0.99	0.99	30,431	30,467	36
2.2 Injector (OPC)	970	926	864	-44	62	0.95	1.07	5,274	5,212	-62
2.3 Linac (OPC)	28	1	38	-26	-37	0.04	0.03	3,326	3,363	37
2.4 Undulator (OPC)	1,152	1,205	825	53	380	1.05	1.46	6,767	6,387	-380
2.5 X-ray Transport (OPC)	489	489	427	0	62	1.00	1.15	4,544	4,482	-62
2.6 X-ray Endstations (OPC)	694	691	324	-4	366	0.99	2.13	5,597	5,231	-366
2.9 Conventional Facilities (OPC)	0	0	0	0	0			683	744	62
2 LCLS Total Other Project Cost	10,005	9,948	9,150	-56	798	0.99	1.09	56,622	55,886	-737
								LCLS Other Project Cost	64,000	64,000
								Avail. Management Reserve	7,378	8,114
								% Management Reserve / ETC	15.8%	17.7%
								% Comp LCLS Other Project Cost	17.6%	17.8%
LCLS Total Project Cost	112,517	109,454	114,047	-3,063	-4,594	0.97	0.96	379,000	379,000	
								% Complete LCLS TPC	32.8%	32.3%

*Management Estimate at Complete includes the Remaining Work (BAC-BCWP), ACWP and proposed Baseline Change Requests.



Cost and Schedule Narrative

The LCLS cost and schedule estimate is consistent with a CD-4 milestone of March 31, 2009 and with a Total Estimated Cost (TEC) of \$315M and a Total Project Cost (TPC) of \$379M. All costs are in actual-year dollars and out-year costs are escalated using guidance provided by the Department of Energy's Office of Engineering and Construction Management (OECM).

The September 2006 Cost Performance Report (CPR) is the 31st month of reporting earned-value on the LCLS TPC. For this month the LCLS cost and schedule indices are 0.96 and 0.97, respectively. Total obligations to date (actual costs + open commitments) are \$141,296K. All approved Baseline Change Requests (BCR's) are available through the LCLS Project Office.

The project critical path runs through the Undulator Facility Co-(early) Occupancy followed by the installation of the undulators followed by FEL beam commissioning and finally photons in the FEH. Total float with respect to CD-4 is 166 working days. LCLS management will aggressively work to maintain or improve this beam commissioning period.

Significant Cost/Schedule Variances

XES Controls System: SPI = 0.87 – The schedule variance for the XES is driven primarily by the Controls Systems, 1.6.2. The XES Controls system has been deferred to focus on the upcoming Injector installation and commissioning period. The XES Controls work has sufficient schedule float to allow for this deferral.

DOE (Level 2) Milestones

System	Level	Milestone	August 2006 ETC	Updated	2004		2005		2006		2007		2008	
					Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr
		Level 2 DOE (SSO) Milestones	8/29/08	10/8/08										
PM	ML2	Prelim Safety Assessment (PSAD) Doc Complete	4/30/04	4/30/04	+									
PM	ML2	DOE External Independent Review (EIR) Complete	6/15/04	6/15/04	+									
PM	ML2	Fire Hazard Analysis Approved	6/30/05	8/15/05			+							
PM	ML2	Prelim Safety Assessment (PSAD) Doc Approved	2/28/06	2/28/06				+						
UN	ML2	Delivery of Undulator 1st Articles to MMF	7/3/06	6/15/06					+					
CF	ML2	Sector 20/Alcove Beneficial Occupancy	7/21/06	4/14/06						+				
CF	ML2	Research Yards Mods Beneficial Occupancy	10/20/06	8/30/06							+			
UN	ML2	MMF Qualified & Ready to Measure Undulators	11/27/06	8/28/06								+		
IJ	ML2	Start Injector Commissioning (Drive Laser)	1/29/07	1/29/07									+	
IJ	ML2	Injector Laser Commissioning Review Complete	1/31/07	1/31/07										+
IJ	ML2	Injector Accelerator Readiness Review (ARR) Comp	1/31/07	1/31/07										
IJ	ML2	Start Injector Commissioning(UV Beam to Cathode)	4/9/07	4/9/07										
CF	ML2	Linac Water/Power Available	7/11/07	7/11/07										
XE	ML2	2-D Pixel Detector Production Start	12/5/07	12/5/07										
LN	ML2	Linac ARR (Li20-Li30) Complete	1/31/08	1/31/08										
CF	ML2	Undulator Facility Beneficial Occupancy	2/29/08	2/29/08										
CF	ML2	Near Experimental Hall Beneficial Occupancy	2/29/08	2/29/08										
CF	ML2	Far Experimental Hall Beneficial Occupancy	2/29/08	2/29/08										
CF	ML2	Front End Enclosure Beneficial Occupancy	2/29/08	2/29/08										
CF	ML2	X-Ray Transport Beneficial Occupancy	2/29/08	2/29/08										
CF	ML2	Beam Transport Hall Beneficial Occupancy	2/29/08	2/29/08										
LN	ML2	Start Linac (Li20-Li30) Commissioning	3/3/08	3/3/08										
PM	ML2	Final Safety Analysis Document (FSAD) Approved	3/31/08	3/31/08										
PM	ML2	LCLS ARR Complete (BTH thru FEH)	7/11/08	7/11/08										
LN	ML2	Start Linac-to-Undulator (LTU) Commissioning	7/31/08	7/31/08										
UN	ML2	Start Undulator Commissioning (1st Light)	8/18/08	8/18/08										
XE	ML2	Start XES Commissioning	10/2/08	10/2/08										
XTOD	ML2	Start XTOD Commissioning	10/8/08	10/8/08										

LCLS Glossary

Actual Cost of Work Performed (ACWP) – Actual cost as reported through the LCLS cost accounting systems, plus any accruals, for a specific WBS#, subproject, or project.

Actual Year Dollars (AY\$) – Actual dollars in the year spent. Budgeted funds also reported in AY\$ to estimate of out-year expenditures and inflation. LCLS uses the escalation rate guidance as recommended by the Department of Energy for Energy Research projects.

Budget Authority (BA) – Cumulative budget currently allocated and authorized by the Department of Energy that may be committed and spent by LCLS for project-related activities.

Budget at Completion (BAC) – The total budgeted cost of the project at completion for a given subproject, or project. BAC is the budgeted cost of the project excluding contingency.

Budgeted Cost of Work Performed (BCWP) – Budgeted value of planned work for a specific WBS#, subproject, or project physically accomplished to date.

Budgeted Cost of Work Scheduled (BCWS) – Budgeted value of planned work time-phased to the schedule for a specific WBS#, subproject, or project.

Commitments – Budget allocated for approved work.

Cost Performance Index (CPI) – The ratio of the value of the work performed to actual cost; $CPI = BCWP/ACWP$. Values less than 1.0 represent “cost overrun” condition, and values greater than 1.0 represent “cost underrun” condition.

Cost Variance (CV) – Difference between the estimated value of the physical work performed and the actual cost expended for a specific WBS#, subproject, or project. $CV = BCWP - ACWP$. A negative result is unfavorable and indicates the potential for a cost overrun.

Estimate to Complete (ETC) – A realistic appraisal of the cost to complete the remaining scope of work.

Management Estimate at Completion – Forecast of the final cost for a specific WBS#, subproject, or project based on the current BAC plus management’s assessment of the cost to complete the remaining scope of work.

Other Project Cost (OPC) – LCLS “supporting” costs not directly contributing to the construction project. OPC costs generally include research and development and pre-operation (start-up) activities.

Percent Complete – The ratio of the work accomplished (earned-value) to the Budget at Completion for any WBS#, subproject, or project. $\% \text{ Complete} = BCWP/BAC$.

Project Engineering and Design (PED) – Funding used to support the engineering and design effort for the LCLS.

Schedule Performance Index (SPI) – The ratio of the value of work performed to work scheduled, $SPI = BCWP/BCWS$. Values less than 1.0 represent a “behind schedule” condition, and values greater than 1.0 represent “ahead of schedule” condition.

Schedule Variance (SV) – Difference between the value of the physical work performed and the value of the work planned (scheduled). $SV = BCWP - BCWS$. A negative result is unfavorable and indicates a behind schedule condition.



Total Estimated Cost (TEC) – The total capital budget authorized for the LCLS project for the construction phase of the project. TEC includes contingency but does not include OPC.

Total Project Cost (TPC) – The total capital budget authorized for the LCLS project, including TEC and OPC.

WBS (Work Breakdown Structure) – A method of hierarchically numbering tasks in a traditional outline numbering format. The WBS provides a basis for the LCLS work plan which is used to track all resources, schedules, and costs.