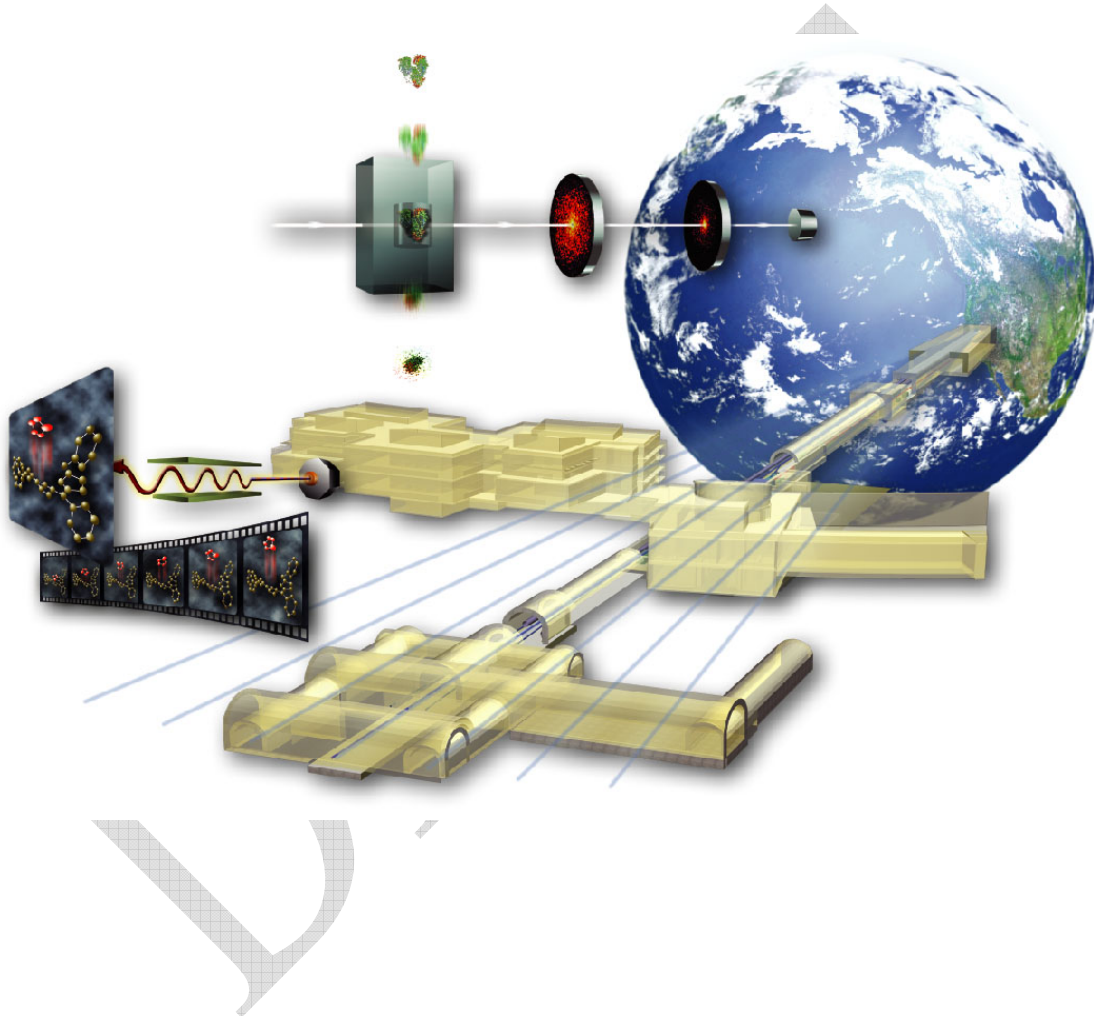


Monthly Report (Draft)

August 2006



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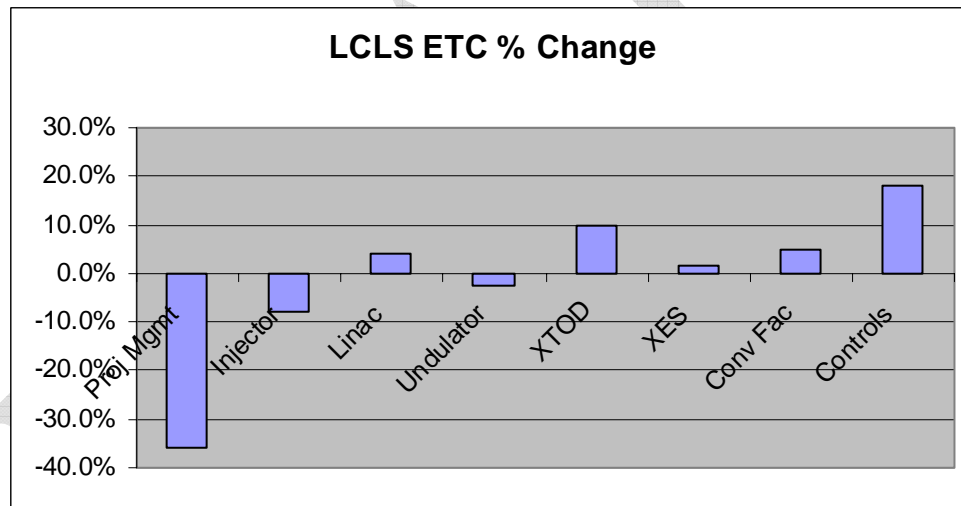
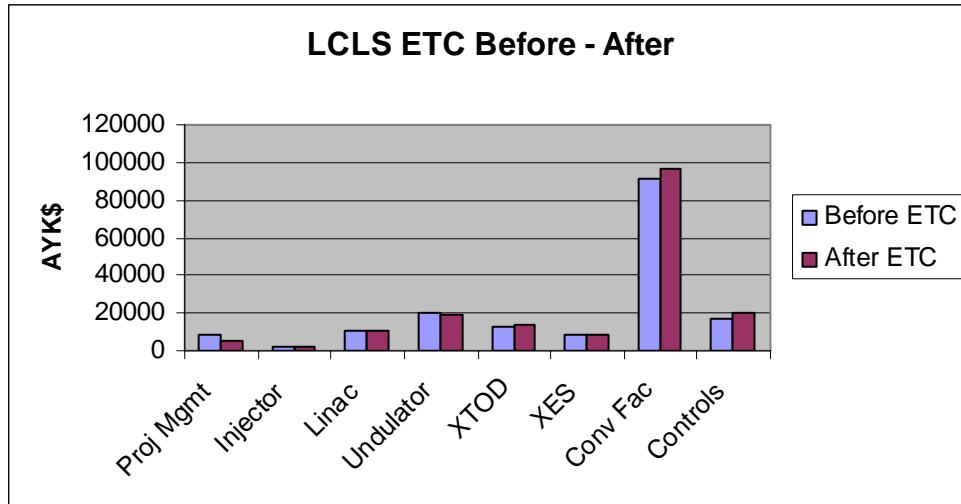
Project Overview and Assessment

Highlights:

- A one-day DOE status meeting of the LCLS Project was held at SLAC on August 29, 2006. The purpose of the meeting was to inform DOE of the project's progress in preparation for construction and to evaluate the overall cost risk to the project in light of the first bids on LCLS Conventional Facilities. The project's go-forward strategy was found to be acceptable although there remains significant cost risk to the project due to the high cost of LCLS construction activities.
- The Undulator, Conventional Facilities and Controls teams conducted their annual review of their cost estimates and presented an Estimate-to-Complete for their respective scopes of work. Overall, Undulator ETC is ~3% decrease, Controls ETC is ~18% increase and Conventional Facilities is ~5% increase. The Baseline Change Requests have not yet been approved by the LCLS CCB.
- LCLS staff presented the civil construction design to SLAC's ES&H Coordinating Committee (ESHCC) in a one-day review on July 14. The purpose of this review was to evaluate SLAC's design calculation and assumptions for radiation shielding and construction safety with an emphasis on oversight and monitoring methods. The committee noted several 'commendable actions' and one 'area of concern' (adequate construction safety training for SLAC staff). LCLS will evaluate its training requirements to ensure that they adequately meet the needs of the LCLS construction site.

Assessment and Issues:

- The August 2006 Cost Performance Reports (CPR) is the 30th 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 \$133,504K.
- LCLS has issued a draft report for the purposes of reporting earned value for August 2006. The Baseline Change Requests (BCR's) related to the Undulator ETC, Controls ETC, Conventional Facilities ETC, Bid Group #2 and removal of the CLOC which estimate future work require CCB approval. When the BCR's have been approved by the LCLS CCB, the August 2006 report will be finalized. The results of the ETC exercise are summarized in the following charts.



Project Office and Support

WBS 1.1, 2.1 Project Planning, Management and Administration

Highlights:

- LCLS Environmental, Safety & Health Status – August 2006.
 - Through the end of August, LCLS worked 106 days without a recordable injury. Prior to an injury reported in May of this year the project had worked 235 injury free days. The LCLS project recordable incident rate is currently 0.59¹, 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 which the SLAC Deputy Fire Marshal is developing responses and will then incorporate those details in the FHA. A revised FHA is planned by September 28.
 - Injector System Accelerator Readiness Review (ARR) and Conventional Facilities Reviews - SLAC Safety Oversight Committee (SOC) reviews required to this point have been completed. The Injector ARR which is tentatively scheduled for the first week in November will be chaired by Frank Kornegay.
 - Emergency Management - TCCo has conducted 2 table top emergency drills. The “Call-Out” process has been established and TCCo understands the importance of notifying the Laboratory at the earliest opportunity. In September a joint LCLS Project Management Team and TCCo table top drill is scheduled.
 - Construction Traffic and Access Gate Coordination – LCLS/TCCo Construction traffic routes within SLAC have been defined and were communicated to SLAC at an all Hands meeting. At this meeting new gate hours for access to the controlled areas resulting from LCLS route interruptions in the Research Yard and PEP Ring Road were defined.
- LCLS Procurement Status – August 2006
 - The LCLS Procurement Department continued with heavy activity in August, 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 – Conventional Facilities value engineering effort continues with Jacobs Engineering. A great deal of effort has been put forth into value engineering the LCLS Conventional Facilities without compromising functionality. SLAC received a proposal for Jacobs costs

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

for this value engineering and negotiations are expected to take place in September.

- CM/GC – In August, SLAC authorized Concrete, Plumbing, HVAC, and Electrical to proceed. Other issues settled in August were agreements on a new subcontract article regarding Field Change Order processes and sharing the costs for Payment and Performance bonds.
- Linac BC1 Chicane Dipole Magnets – Subcontract awarded. Significant design progress was made in June and July with delivery to SLAC completed in late August.
- Injector Laser Heater Chicane Dipole Magnets – Subcontract awarded. The December delivery date is acceptable.
- Injector Quadrupole Magnets – Subcontract awarded. All critical items have been received. One remaining item (non-critical) will ship in December.
- Controls and Power Supply Racks – Subcontract awarded. The heat-sink problem was resolved in June resulting in delivery in October.

Assessment and Issues:

- An observation was made regarding the discrepancy between levels of PPE worn by the various workers in the S20 injector housing. The subs were, for the most part, in PPE prescribed by the LCLS ES&H Plan while most of the SLAC employees were not. This has been rectified by requiring installation work to follow the LCLS Project ES&H Plan.

Electron Beam Systems

WBS 1.1, 1.x.2 Controls System

- Management and Safety –
 - An Installation Readiness Review for the control system was held on August 30. While the approach, scope and scheduling of the work met with approval, the main concern as stated in the review report is: “to much to do, too little time, too few people, overloaded shops, and parts coming late in the down”.
- A final design review and an Electrical Safety Committee review for the S20 cable plant were both held in August. Approval was obtained to proceed with the bidding and installation. The potential bidders did a site visit and a Davis Bacon contract was awarded for Phase II cable installation. The installation is scheduled to start September 25, 2006
- The schematic for the PAD has been finished and reviewed. The board will be used for the LLRF and BPM systems. Parts for 50 of the 4 channel PAD control boards are being ordered. The PAD slow ADC board has been tested the layout corrected and 25 boards and parts ordered.
- X-Band testing of the TWT amplifier has started. The amplifier will meet LCLS jitter specifications, but further testing is required to measure actual jitter. Quick measurement shows jitter is at or below 0.2 degrees, the LCLS spec is 0.5 degrees.
- All of the device drivers for the IP cards are ready, including the solenoid control, shutter control, lens control, MPS reference, power supply control, Beam Charge Monitor, Laser Power Measurement, and the Analog Input module.
- Good progress has been made on testing the SLC-aware IOC with the new magnet software. The Controls group can successfully control a magnet via EPICS screens and have the changes be reflected in the SCP. The EPICS and the legacy magnet control system are now synchronized.

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:

- Management and Safety –
 - The Safety Overview Committee Injector/Linac installation approval to proceed signoff sheet was been signed by all the SOC members.
 - An installation readiness review was held on August 16. First priority for Injector-Linac is the installation of equipment in the Linac Housing and second priority is installation of equipment in the Injector Vault.
- Drive Laser – The installation of the drive laser was completed. Table leg grouting and room cleaning was done in the laser bay following the installation of the drive laser. Streak camera installation started. Some remaining room finishing will be done prior to FROG installation. The Swamp Optics FROG will be installed in September.
- Installation of Injector S-Band waveguide started with installation of the waveguide hangers. Lateral bracing of the waveguide hangers was requested; however, the bracing as requested could not be built. A solution was found and approved. The bracing was be added to the waveguide hanger installation contract.
- The LOB disk loaded waveguide dual feed assembly was final-brazed. LOA completed bakeout and was checked for straightness. Both LOA and LOB will be straightened prior to installation.
- Injector quadrupoles were identified by serial number from magnetic measurement data for installation in specific locations in the beamline. Calibrated and serialized BPMs were matched to quadrupoles for installation. Recorded data by component serial number will be uploaded into the LCLS controls database.

Assessment and Issues:

- Vibration measurements were performed in the drive laser room. Mitigation of water induced vibration is being investigated. It was requested to shutdown the Sector 20 and Sector 21 water pumps for a brief period to measure their affect on room vibration. Plates over the Li-20 roadway trench were not replaced as scheduled. Replacement of the plates will reduce traffic-induced vibration in the Laser- Bay.

WBS 1.3, 2.3 Linac System

Highlights:

- SLAC's 2006 shutdown started August 21st. Equipment was staged prior to the start of the down to vent Linac Sectors 20 and 21. Crews were assembled and began the first week's work; removing accelerator sections in Linac Sector 21.
- An engineer assignment matrix was established for L2, BC2, L3, LTU, E-Dump region integration as well as component and systems. This is in preparation of migrating design emphasis from 2006 downtime components to downstream work. Coordination will be established with Controls for identifying needed engineering teams.
- One request (machining and assembly of adjustable support assemblies for the 2007 down) was sent to purchasing to test the newly established Blanket Order Agreement (BOA) procedure.

Assessment and Issues:

- The ISA toroid ceramic braze failed acceptance test. It was determined that the vendor was experimenting with an active-metal braze alloy. After an evaluation, SLAC requested that the vendor use conventional ceramic metalization and braze alloys.
- The vendor for the BC1 chicane dipoles shimmed the pole faces but could not bring them into tolerance for quadrupole and sextupole errors. As the BC1 magnets are critical components for the current shutdown, LCLS requested the vendor to ship the magnets to SLAC where resident experts would provide the final tuning of the magnets. The magnets arrived at SLAC on August 25, and final magnetic measurements are underway.
- A leak was isolated to the BC1 Vacuum Chamber bellows end eyelets. Discussion with the vendor revealed that the eyelets were machined from plate, not cross-forged, nor spinnings. The vendor re-made the bellows using spinnings as end eyelets to avoid air-to vacuum pipes. The bellows were delivered to SLAC, fired and ready for installation. The repair of the chambers was delayed however, in order to measure the BC1 dipole magnets with the chamber in the magnet gap. The repair will be completed following tuning of the BC1 bend magnets.

WBS 1.4, 2.4 Undulator System

Highlights:

- Management and Safety – The Undulator group is in the process of updating its Estimate to Complete (ETC). The revised ETC will be submitted to the LCLS Change Control Board for approval in August.
- Undulators –
 - Both undulator assembly vendors are performing very well and ANL has requested authority to go forward with the purchase of the remaining undulators in a 50/50 split with the vendors.
 - Six completed undulator assemblies were shipped to SLAC. The production of undulators is now at 25% complete (10) and on schedule.
- Undulator System Integration – A SLAC/ANL joint meeting was held to discuss all features and performance criteria of the support mover system. The result of this meeting was an action item list to be completed before the final design review scheduled for September 14th & 15th at ANL.
- Magnetic Measurement Facility – The MMF air temperature performed well in August due largely to an upgraded compressed air system with a larger storage tank and piping to remedy the problem of not having enough air available to run the CMM, Kugler and Dover benches simultaneously.

Assessments and Issues:

- The undulator vacuum chamber 4-weld design continues to be a high risk due to significant fabrication challenges. A 42” section is under fabrication and a full length prototype due in October. This item is a critical component of the LCLS and requires careful attention to its fabrication and assembly.
- The MMF Setup, WBS 1.4.3.6.1, continues to run behind schedule and over budget. Robert Ruland, SLAC’s Metrology Head, has implemented a daily 11:40 AM status meeting to communicate progress to the LCLS Project.
- The PC Gun has a serious problem with it that needs correction before it can be reinstalled and used for the RF BPM tests. This required work is being done; however, it looks doubtful that the PC gun will be installed in the APS linac during the October shutdown. This will delay final testing of the RF BPMs.

Photon Beam Systems

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

Highlights:

- Management and Safety – Integrated Work Sheets (IWS) detailing the implementation of an Integrated Safety Management System (ISMS) for the Gas Detector, Total Energy Measurement System, and the Tunnel Vacuum System were reviewed by the XTOD group. The IWSs for the Gas Detector and Total Energy Measurement System have been passed to LLNL's safety team for formal review. The IWS for the Tunnel Vacuum System has been reviewed by LLNL's safety team.
- Attenuator – The final phase of the prototype gas attenuator testing will be resumed immediately after the delivery of one turbopump and one screw pump. To demonstrate long-term stable operation, the test plan includes detailed measurement of turbopump operation parameters such as speed and temperature.
- Gas Detector – A preliminary design of the solenoid for the gas detector has been created. The goal is to use an electromagnetic winding to produce an axial field of about 400 gauss to keep the photoelectrons from striking the walls of the vessel. A prototype coil was fabricated and tested in the laboratory. The tests of this coil suggest that with active air cooling the temperature increase is only ~ 20°C, suitable for long-term stable operation (see figure).
- Low Energy FEL Offset Mirror System – Thin film samples of the B₄C and SiC coatings for the mirrors were fabricated for damage testing at the FLASH VUV FEL facility at DESY in Hamburg, Germany.
- Beam Simulation – Monte Carlo simulations of the spontaneous radiation at the position of the direct imager were started. These runs include low and high energy spontaneous radiation from the full undulator, as well as low and high energy spontaneous radiation from a single (the first) undulator segment. The simulations also calculate the amount of energy deposited in YAG scintillator plates, 5, 50, and 1000 microns thick. These will be used as input to the calculation of the visible light from the scintillator, its capture by the optics, and its conversion into photoelectrons in the camera.
- The System Concept Review for the Total Energy Measurement System was held August 17. The review committee was concerned about the survivability of the detector at full beam power, the loss of energy through radiation, and the choice of technologies. Another SCR addressing these issues is to be held within the next 6 weeks.

- Tunnel X-Ray Vacuum Transport System – There was a presentation to the SLAC Earthquake Citizens Committee about the XVTS on July 21. The XVTS Final Design Review has been postponed by a couple of months, due mainly to slow responses from potential vendors for engineering cost estimates. This does not present a schedule problem.
- Controls – A major reconfiguration of the controls logic was done to break the single diagnostic tank in the FEE into three, with independent vacuum and dedicated CPUs. The three tanks contain the K spectrometer, the Total Energy Measurement System, and the Direct Imagers. The separate vacuum elements of the two Gas Detectors and Gas Attenuator were combined into a single entity with three gas flows. The FEE rack and PLCs were re-balanced to optimize use of space in the FEE.

Assessment and Issues:

- The Interface Control Document between XTOD and Linac needs to be modified to take into account the fact that the Fast Close Valve will now be located upstream of the FEE (though the sensor remains in the FEE).
- The SLAC vacuum group requirement of having no elastomer seals associated with the beamline vacuum system needs to be reexamined and updated to better apply to x-ray beamlines. The radiation issues associated with electron accelerators are very different from those associated with x-ray transport. There is a great opportunity for savings on component costs, by using elastomer seals in places (such as at beamline side ports and for backing pumps) where the radiation dose is very small. This issue, along with related issues regarding SLAC standards for pump controls, reflects the growing pains associated with the merging of “accelerator” and “x-ray” communities being forced upon SLAC by LCLS. These issues must be resolved quickly, as they affect many details of the XTOD designs.

WBS 1.6, 2.6 X-Ray Endstation Systems

Highlights:

- The XES group finalized the Estimate to Complete (ETC) revalidation. The BCR related to the ETC was approved. The XES Controls WBS 1.6.2 has been revised in parallel but will be submitted separately.
- 2D x-ray Detector: Work has started on defining the controls requirements for the 2D detector. This is being done in conjunction with LCLS controls group. Work at Cornell is proceeding on schedule towards a submission of a third prototype in the beginning of October. As the 2D detector will be used primarily for the coherent imaging experiment, a list of questions and requirements has been prepared and sent to the science group leaders to coordinate the design details and users' requirements.
- AMO Instrument: A graduate student with the AMO science group leader Louis DiMauro at Ohio State University visited LCLS in August and began modeling the performance of the electron time-of-flight spectrometers. Modeling indicates that a multi-stage deceleration lens is required to preserve the transmission of the spectrometers while raising their resolution. Documentation of the overall AMO instrument capabilities is nearing completion.
- Controls: Conceptual design has started in the areas of the AMO instrument and 2D detector. Documentation of the interfaces to these systems and their engineering specifications has begun.

Assessment and Issues:

- Only minor progress has been made in the area of Personal Protection Systems (PPS) and Beam Containment Systems (BCS) for the X-Ray systems, as activities in other systems took precedence. This does not present a critical delay at this point. Work was started on defining the requirements for the PPS stoppers and working towards a Physics Requirement Document.
- 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:

- The FFTB Soil Excavation project was successfully completed on schedule with no loss-time incidents. This project was managed by the LCLS CF group.
- Funding to cover construction cost thru FY06 was provided to TCCO for Bid Group #1 subcontracts, which include; surveying, earthwork, concrete, tunneling, site utilities, plumbing, HVAC and electrical.
- A major Design Change Notice (DCN) was provided to Jacobs Engineering for additional Value Engineering for the LCLS beampath civil construction. The civil design is being reviewed to provide a potential significant savings in concrete.
- Participated in the Central Lab Office Complex (CLOC) pre-bid job walk and bidders conference. Several subcontractors were in attendance indicating a strong interest to the project. The CLOC bids (bid group #3 and #4) are scheduled to be received Sept 14 and Sept 21.
- The CF Estimate to Complete (ETC) continues to make progress.
- The CF group contracted a local Bay Area major estimating firm to provide a cost analysis of the 2 story CLOC. See Issues and Assessments.

Issues and Assessments

- Fire Protection bid package (part of Bid Group #1 bids received) will be rebid by TCCO. The sole bid received was considered unresponsive.
- The FFTB Excavation critical path project was completed ahead of schedule in preparation of the major TCCO site activities.
- The CF group has contracted with The Saylor Group (a local Bay Area estimating firm) to provide a cost analysis. The total estimated construction cost was indicated to be \$22.3M (\$431/sf). This cost includes a \$2M penalty for the local Bay Area bidding climate and current market conditions.
- Bid Group #2 results continue to be reviewed by TCCO. A final analysis and recommendation is pending from TCCO.



LCLS Cost and Schedule Performance – August 2006

LCLS Cost/Schedule Status Report - Work Breakdown Structure										31-Aug-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	17,478	17,011	19,823	-468	-2,812	0.97	0.86	25,391	28,200	2,809	
1.2 Injector	17,355	16,441	18,523	-914	-2,081	0.95	0.89	20,466	22,656	2,190	
1.3 Linac	9,163	8,757	8,339	-406	418	0.96	1.05	27,169	26,530	-639	
1.4 Undulator	18,735	17,842	19,279	-894	-1,438	0.95	0.93	40,597	42,579	1,982	
1.5 X-ray Transport	9,554	9,484	9,590	-70	-106	0.99	0.99	24,604	24,758	154	
1.6 X-ray Endstations	1,380	1,294	1,263	-86	31	0.94	1.02	15,360	16,365	1,005	
1.9 Conventional Facilities	22,719	23,059	22,318	340	741	1.01	1.03	118,943	118,182	-761	
1 LCLS Total Base Cost	96,386	93,887	99,135	-2,498	-5,247	0.97	0.95	272,530	279,269	6,740	
LCLS Total Estimated Cost								315,000	315,000		
Avail. Contingency								42,470	35,731		
% Contingency / ETC								23.8%	19.3%		
% Complete LCLS Base Cost								34.5%	33.6%		
2.1 LCLS Project Mgmt, Planning & Admn (OPC)	6,418	6,155	6,207	-263	-53	0.96	0.99	30,431	30,716	285	
2.2 Injector (OPC)	887	799	857	-87	-58	0.90	0.93	5,274	5,255	-19	
2.3 Linac (OPC)	28	1	31	-27	-30	0.04	0.04	3,326	3,367	41	
2.4 Undulator (OPC)	1,127	1,105	825	-22	279	0.98	1.34	6,767	6,464	-303	
2.5 X-ray Transport (OPC)	489	489	427	0	62	1.00	1.15	4,544	4,487	-57	
2.6 X-ray Endstations (OPC)	663	596	270	-67	326	0.90	2.20	5,597	5,270	-327	
2.9 Conventional Facilities (OPC)	0	0	0	0	0			683	683	0	
2 LCLS Total Other Project Cost	9,611	9,145	8,618	-465	527	0.95	1.06	56,622	56,241	-381	
LCLS Other Project Cost								64,000	64,000		
Avail. Management Reserve								7,378	7,759		
% Management Reserve / ETC								15.5%	16.5%		
% Comp LCLS Other Project Cost								16.2%	16.3%		
LCLS Total Project Cost	105,996	103,033	107,753	-2,964	-4,720	0.97	0.96	379,000	379,000		
% Complete LCLS TPC								31.3%	30.7%		

*Management Estimate at Complete includes the Budget at Complete, a weighted CPI and SPI, proposed Baseline Change Requests and known risk contingencies.

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 August 2006 Cost Performance Reports (CPR) is the 30th 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 \$133,504K. Approved Baseline Change Requests (BCR's) are shown in the table below. 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

Project Management: SPI = 0.97, CPI = 0.86

The cost variance in Project Management is being driven by three items; in the LCLS Project Office and Project Support vacation time has been lower than planned, and there have been higher than expected M&S (start-up) costs. The budgets for each of these is LOE and they are expected to correct over time.

Injector System: SPI = 0.95, CPI = 0.89

The Injector team has been very cautious with the production of the RF Gun and the L0a and L0b Accelerating structures. This has led to schedule delay and cost increases in these areas.

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.

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