LCLS Risk Registry
april 2007

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1.1	**Management**														
R1.1-001	Change and Earned-Value Management Control Processes	5/52004	Mark Reichanadter	10/2/2006	Mark Reichanadter	If a baseline change control and earned-value management processes are not effective,	Design, Construction	**2%**	**2%**		**$0**		Mitigate	1. Upload to LCLS Website all BCR's and CPR's (T. Mast) 2. Document minutes from monthly cost/schedule meetings with action items (M. Reichanadter, D. Schultz, J. Arthur, J. Albino) 3. Finalize Earned-Value Management Corrective Action Plan (M. Reichanadter) 4. Develop an understanding/process for possible civil construction claims settled late in the project (J. Albino)	**12/31/2006**
R1.1-002	Lack of documented Cost Estimate	5/52004	Mark Reichanadter	10/2/2006	Mark Reichanadter	IF project costs are not properly documented, and supported with accurate backup information	Design, Construction	**2%**	**2%**		**$0**		Mitigate	1. Update each L2 cost estimate (ETC) annually (POC: M. Reichanadter) 2. Each L2 system will document cost estimate in their Basis of Estimate (M. Reichanadter, D. Schultz, J. Arthur, J. Albino)	**12/31/2006**
R-1.1-003	Lack of well-understood project schedule	5/52004	Mark Reichanadter	10/2/2006	Mark Reichanadter	If the project schedule is inaccurate due to incomplete planning or logic errors/omissions,	Design, Construction, Commissioning	**5%**	**5%**		**$0**		Mitigate	1 Update project critical path and near critical paths each month (T. Mast) 2. Present Level 4 milestones in weekly management meeting (T. Mast)	**12/31/2006**
R1.1-006	Project Personnel Staffing	5/52004	Mark Reichanadter	6/7/2006	Mark Reichanadter	If the project cannot recruit high-quality personnel to key positions,	Design, Construction, Commissioning	**2%**	**2%**		**$0**		Mitigate	With the re-organization of SLAC's upper management, LCLS management will work closely with the SLAC Director, Deputy Directors and Chief Operations Officer to ensure the personnel needs of the LCLS project. In particular, there is a large demand on SLAC Operations Division (CEF, MFD and Rad Physics). Regular communication with the COO will be necessary to stay up with peak demand requirements.	**12/31/2006**
R1.1-007	Integration of SLC Control system Alpha to EPICS IOCs	5/9/2004	L.R. Dalesio	11/7/2005	Hamid Shoaee	IF we fail to implement Alpha functions 1-simple polled data transfer 2-Timed acquisition for beam synchronous data 3-Buffered acquisition of beam synchronous data THEN the applications developed within the SLC controls system will not Function for linac sectors 20-30. This Will slow LCLS commissioning and Hinder or prevent operation of the linac in traditional modes.	Construction, Commissioning	**50%**	**$0**		**$0**		Mitigate	1-identify all SLC-micro message types 2-write message emulators for EPICS IOCs	**12/31/2006**
R1.1-008	LCLS Timing System	5/9/2004	Hamid Shoaee	1/29/2007	Dave Schultz	If there is a delay in implementation or technical deficiency in the following: • PNET receiver for EPICS • Master Pattern Generator for EPICS • Event Receiver for EPICS • Timing Distribution network THEN, the existing SLC control system and the new LCLS controls will not be integrated, preventing operation of the LCLS from the MCC and rendering useless many essential SLC controls and many new LCLS devices such as the BPMs.	Construction, Commissioning	**30%**	**$0**		**$0**		Accept	Timing system Design Review 11-15-2006	**retire 1-29-07**
R-1.1-009	Serious Accident on the SLAC Site	1/3/2005	Mark Reichanadter	10/2/2006	Mark Reichanadter	IF there is a serious accident on the SLAC site by SLAC employee, contractor or visitor	Design, construction, commissioning, pre-operations	**2%**	**$0**		**$0**		Mitigate	1. Weekly inspections of construction site (J. Galayda, M. Reichanadter, M. Scharfenstein, R. Hislop) 2. Perform and document Safe Observation Process (All, monitored by M. Scharfenstein) 3. Weekly safety minutes in OAC meeting and LCLS Mgmt meeting (M. Scharfenstein)	**12/31/2006**
R-1.1-010	Co-Location of Core LCLS Staff	1/3/2005	Mark Reichanadter	3/17/2006	Mark Reichanadter	If the core team of managers, scientists, engineers, and designers cannot be co-located at its three partner labs	Design, construction, commissioning, pre-operations	**30%**	**$0**		**$0**		Avoid, mitigate	In general, LCLS will communicate regularly with Lab management at SLAC to facilitate the co-location of the central design group in B280. As of Sep05, LCLS occupies Module A and Module B of B280 (13,000 sq ft. ~84 offices). There are still LCLS people not co-located, particularly in engineering and design. With the start of construciton scheduled for March 2006, the CF will relocate near construction in B211, opening up additional offices for co-locating the engineering and design team. LCLS will continue to communicate its space needs to SLAC management. For ANL and LLNL have similar plans in place to co-locate their staff.	**Retired 10/2/2006**

LCLS Risk Registry
april 2007

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R-1.1-011	Equipment Storage and Staging Area	1/3/2005	Mark Reichanadter	3/17/2006	Richard M. Boyce	IF the LCLS cannot obtain secure storage space for equipment and deliverables prior to installation	Construction, commissioning, pre-operations	**10%**	**$0**		**$0**		Avoid, mitigate	The LCLS Installation Manager will prepare a detailed space planning memo that will allocate the necessary space for equipment staging by February 2006. Areas identified for LCLS to date are: B026 for magnets and equipment; B750 (104) for Undulator assy & storage by Dec '06; B750 (106) for X-ray/Far Hall hardware staging by Jan '07; storage trailers identified at MFD hub for LCLS fabricated parts. Asst. Manager for Undulator has been hired at SLAC and will coordinate the flow of materials for undulator installation.	**12/31/2006**
R-1.1-012	Funding Shortfall due to FY06 Continuing Resolution	3/14/2005	Mark Reichanadter	2/21/2006	Mark Reichanadter	IF the U.S. Congress does not approve the FY06 budget in a timely manner	PED, LLP, Construction	**50%**	**$1**		**$0**		Avoid, mitigate	1/12 of PED, LLP and OPC funds will not be adequate to maintain staffing or procurements. Under this scenario, LCLS will still need FY05 carryover (~$13M) to maintain continuity of project. Mar06 start date is at lesser risk than maintaining staffing and coherence of the project.	**X 12-7-05**
R-1.1-013	Lack of formally approved specifications (PRD's, ESD's, ICD's)	4/18/2005	Mark Reichanadter	10/2/2006	Mark Reichanadter	IF the LCLS specifications are not well-defined and documented in a formal manner	PED, LLP, Construction	**10%**	**$0**		**$0**		Avoid, mitigate	1. Document and present once per month # of PRD's/ESD's/ICD's/system. How many approved/week/month? Plot trends. (Darren Marsh)	**12/31/2006**
R-1.1-014	PLC PPS Design Evaluation	3/31/2005	P. Krejcik	10/3/2006	Hamid Shoaee	If the SLAC Citizen Review Committee does not accept the use of Programmable Logic Controllers in the Personnel Protection System and condones only old electromechanical logic systems Then it will be difficult to implement a sophisticated safety interlock system that can be commissioned and verified within the scheduled time and maintained in the future.	Design, Construction	**10%**	**$0**		**$0**		Mitigate, Accept	1) Michael Saleski(LCLS) and John Forestal (APS) added 01/06. 2) Complete the design review(s) in March 2006 3) Complete the citizen review for PLC use in second quarter of FY06 COMMENTS: Many other laboratories have used PLCs for PPS, but is has never been used at SLAC. One previous attempt to use PLCs at SLAC did not pass the Citizen review.	**x 10-3-2006**
R-1.1-015	Linac Reliability	6/3/2005	Dave Schultz	1/29/2007	Dave Schultz	If the reliability of the Linear accelerator is not high … then the experimental beam time will be impacted.	Operations	**30%**	**$0**		**$0**	**#REF!**	Mitigate	Steps for Handling: 1) Estimate availability of existing SLAC magnet power supply systems. (July 2005) 2) Investigate availability options for magnet power supply systems. (Dec 2005) 3) Develop a availability budget for all Linac systems to identify and understand problem areas. (Mar 2006) 4) Develop plans to improve availability of identified critical areas. (May 2006)	**RETIRE 1-29-07**
R-1.1-016	LCLS MPS System	6/6/2005	Patrick Krejcik	1/29/2007	Dave Schultz	If the Machine Protection System fails to respond and shut of the beam within one machine pulse of detecting a critical component failure or a beam loss … Then the sensitive components of the machine, in particular the undulator, will be put at considerable risk of being permanently damaged and will require replacement.	Design, Construction, Commissioning, Pre-Operations	**10%**	**$0**		**$0**		Mitigate, Accept	MPS Design Review 11-09-2006	**retire 1-29-07**
R-1.1-017	Beam Diagnostic Control Systems	6/6/2005	Patrick Krejcik	10/3/2006	Hamid Shoaee	If the beam parameters cannot be measured with sufficient precision on a shot by shot basis … Then the beam cannot be reproducibly tuned to the desired values for FEL operation	Design, Construction, Commissioning, Pre-Operations	**25%**	**$0**		**$0**		Mitigate	1. Specify the requirements for diagnostic devices (Schedule for the Steps: 2004-2005) 2. Evaluate diagnostics at other laboratories (Schedule for the Steps: 2004-2005) 3. Build prototype BPM stripline receiver (Schedule for the Steps: 3-2006) 4. test prototype stripline receiver in SLAC linac (Schedule for the Steps: 6-2006) 5. Build and test cavity BPM and electronics at APS, subject to APS schedule 6. Test and integrate devices with controls (Schedule for the Steps: 3-2005 thru 10-2006) 7. Build and install bunch length monitor on the BC1 vacuum chamber and test during LCLS commissioning (Schedule for the Steps: 6-2006 thru 12-2006) Comments: The first priority diagnostics are cavity BPMs and bunch length monitors. Second priority are wire scanners with beam loss monitors and Profile Monitors	**x 10-3-2006**

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R-1.1-018	Main Control Center Upgrades	6/6/2005	Patrick Krejcik	11/7/2005	Patrick Krejcik	If the Main Control Center is not upgraded to accommodate the LCLS requirements … then the operations center cannot have oversight of the LCLS commissioning and the LCLS PPS and MPS, nor assist in the commissioning procedures	Construction, Commissioning, Operations	**33%**	**$0**		**$0**		Mitigate	1. Specify the requirements for commissioning and operation (Schedule for the Steps: 2004) 2. Evaluate control rooms at other laboratories (Schedule for the Steps: 2004-2005) 3. Review requirements with operations staff (Schedule for the Steps: 2005) 4. Plan a decommissioning schedule around present PEP II operations (Schedule for the Steps: 2005) COMMENTS: The biggest hindrance is getting the obsolete racks out of the way to allow for renovation and installation of modern furniture and display systems. The decommissioning can only take place during a very limited number of PEP II shutdowns. The schedule planning has not been approached yet. NOTE: The MCC job has been descoped.	**X 11-7-05**
R1.1-018	Tracking Project Personnel	10/2/2006	Mark Reichanadter	10/2/2006	Mark Reichanadter	If the project cannot track actual FTE's against budgeted FTE's	Design, Construction, Commissioning	**2%**	**$0**		**$0**		Mitigate	LCLS PMCS group to develop a spreadsheet comparing FTE's budgeted to FTE's worked (T. Mast, M. Abela)	**12/31/2006**
R1.1-019	Endgame Planning	10/2/2006	Mark Reichanadter	10/2/2006	Mark Reichanadter	The project does not have a clear understanding of requirements for the end of commissioning … then there is the potential for budget overruns as staff stay on the project into the operations phase	Commissioning	**2%**	**$2,000**		**$40**		Mitigate	1. Establish physics commissioning goals for Injector, Linac, Undulator, FEL (P. Emma) - March 31, 2007	**12/31/2006**
R1.1-020	Contingency Analysis	10/2/2006	Mark Reichanadter	10/2/2006	Mark Reichanadter	The project does not have a clear understanding of its contingency needs for the remainder of the project … then there is the potential for committing to too much (or not enough) scope.	Design, Construction	**10%**	**$5,000**	**2**	**$500**		Mitigate	1. Perform a semi-annual bottoms-up risk-based contingency analysis on remaining work (T. Mast) 2. Perform a Monte-Carlo assessment annually to validate the bottoms-up contingency analysis (T. Mast). 3. Perform monthly assessment of Estimate at Complete (M. Reichanadter). 4. Perform monthly assessment of contingency on 'commitments to go' after reserving adequate contingency for scope under contract.	
R1.1-021	Control Account Mischarges leading to Variances	10/2/2006	Mark Reichanadter	2/22/2007	System Managers (Schultz; Reichanadter; Saenz; Arthur)	The project control acounts are not regularly monitored … then there is the potential for mischarges which lead to erroneous variances.	Desig, Construction, commissioning	**20%**	**$5,000**	**2**	**$1,000**		Mitigate	• Establish procedures to close control accounts - January 2007. • Establish Hammer Tool to track budget vs actuals – January 2007.	
R1.1-022	Installation Schedule	10/19/2006	R.M. Boyce	3/15/2007	R.M Boyce	If the major installation period beginning November 2007, is not well-doumented and integrated throughout the project … then there is a risk of not meeting the start of commissioning milestones	Construction, Installation	**20%**	**$5,000**	**$1,000**	**$1,000**		Mitigate	1. Establish high level management meetings to review installation schedule and milestones - May 25, 2007 (Use Senior Mgmt Meeting) 2. Determine scheduling and reporting methods to be used for downtime - April 2, 2007 (Done - will use P3) 3. Integrate LCLS installation planning with other SLAC Operating programs to lessen impacts - April 15, 2007 (Done - PMOG mtgs) 4. Establish planning meetings to develop and integrate installation & checkout tasks at systems levels - April 15, 2007 (Done - Weekly installation meetings) 5. Create, distribute and review the installation schedule to ensure total project wide agreement - April 15, 2007 (Done - distributed and in review) 6. Establish Blanket Ordering Agreements (BOA) for installation - Aug 15, 2007	
R-1.1-023	Deputy Controls Manager	4/9/2007	Dave Schultz	4/9/2007	Dave Schultz	If LCLS Controls manpower needs cannot be filled in a timely manner … then personnel overload will lead to poor documentation and delays.	Design, Construction	**50%**	**$100**	**3**	**$50**	**$50**	Mitigate	• Offer to qualified person (Mar. 07) - turned down • Make offer(s) to others (Apr. 07)• Review risk (May 07)	
R-1.1-024	FY08 TEC Budget Authority	4/30/2007	Mark Reichanadter	4/30/2007	Mark Reichanadter	If LCLS requires larger than estimated contingency usage in FY08 … then critical FY08 planned procurements may need to be deferred.	Design, Construction	**20%**	**$500**	**2**	**$100**		Mitigate	• Track on a monthly basis (actuals + ETC) to ensure sufficient budget authority remains to complete critical FY08 tasks. • Identify and prioritize non-critical procurements that can be deferred if additional funding is needed for critical FY08 tasks.	
R1.1-025	SSO Prior Approval of Bids & Contracts >$100K	6/28/2007	David Pindroh	6/29/2007	David Pindroh	From 6/25/07 through 12/31/07 the DOE SSO is requiring prior approval on that all RFP's, IFB's, RFQ's, and subsequent contract awards >$100K resulting in bidding and awarding delays from 6-10 days.	Construction, Installation & Commissioning.	**15%**	**$1,000**	**2**			Mitigate	1. Perform extensive and timely internal LCLS review of all bid and award packages prior to submittal to SSO. 2. Alert LCLS requesting staff of additional time delays. 3. Provide SSO with advance notification of "critical" pending reviews 4. Establish a log to of all SSO-reviewed procurement and track status and through-put time for internal reviews and SSO.	
1.2	**Injector System**														
1.3	**Linac System**														
1.4	**Undulator System**														

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R-1.4-025	Vacuum Chamber Development Schedule	3/8/2006	S. Milton	7/6/2007	David Schultz	IF the undulator vacuum chamber does not meet specification…then an alternate back-up chamber will have to be developed with a subsequent delay ot the turn on of the beam for the complete undulator system	Design, commissioning	**20%**	**900**	**2**	**90**		Mitigate	Develop aluminum extrusion vacuum chamber as the primary production chamber. Prototype due 8/7/2007. Carry development of a back-up copper tube vacuum chamber through the prototype stage by 8/21/2007.	
R1.4-026	RF BPM Schedule	3/8/2006	S. Milton	5/18/2007	David Schultz	If the schedule for the rf bpms cannot be improved … then the rf bpms will delay the assembly in the MMF and subsequently delay the turn on for the beam through the complete undulator system.	Design, Commissioining	**20%**	**$400**	**2**	**$80**		Mitigate	• 3-BPM test (May 2007) • Review risk again in detail (June 2007)	
1.5	**X-Ray, Transport, Optics & Diagnostics System**														
R-1.5-006	Late changes to design due to evolving user requirements	1/6/2005	Richard Bionta	3/15/2007	John Arthur	If there are major changes in the scope, performance, existence or placement of XTOD instrumentation due to evolving user requirements…Then, it will be difficult to meet the schedule and budget as specified in P3.	Design, Construction, Commissioning	**10%**	**$100**	**2**	**$10**		Mitigate	1) Adhere to BCR process. 2) Participate in Experimental Area design process 3) Formalize XTOD-LUSI interfaces with ICD by July 2007 4) Develop computer beam and instrumentation tools to allow accurate assessment of proposed changes.	
R-1.5-013	Mirror procurement delay	10/10/2006	John Arthur	3/15/2007	J. Arthur	IF there are major delays or difficulties with procuring x-ray mirrors that meet technical requirements … THEN mirror installation may be delayed and/or mirror cost may rise.	Construction	**10%**	**$250**	**2**	**$25**		Mitigate	1) Develop mirror specs, begin discussions with vendors early. 2) Evaluate specs at SCR's Spring 2007 3) Procure mirrors with sufficient schedule float to activate backup plan if necessary.	
R-1.5-014	Mirror mounting design immaturity	10/10/2006	John Arthur	3/15/2007	J. Arthur	IF it proves difficult to meet technical specs for mirror mounting … THEN the mirror mounting schedule and/or cost plans may be exceded.	Design, construction	**10%**	**$200**	**2**	**$20**		Mitigate	1) Develop mirror mount specs early (SCR's Spring 2007). 2) Consider both procurement from outside vendors and internal fabrication. 3) Consider building small prototype to prove design. 4) Allow schedule for evaluation of prototype.	
1.6	**X-Ray Endstations System**														
R-1.6-008	Pricing fluctuations for procurement items	4/1/2005	S. Moeller	3/15/2007	J. Arthur	IF the prices for procurement items or the exchange rate for foreign procurements increases rapidly in the next years … THEN the actual cost for procurements will be higher than our current cost estimates	Construction	**25%**	**$100**	**2**	**$25**		Accept	Monitor prices of items that will be procured in the later years and especially from vendors that are the only suppliers of the items. Allow for sufficient contingency.	
R-1.6-009	Scope uncertainties due to evolving requirements early in the design phase of the Atomic Physics Instrument	3/16/2006	S. Moeller	3/15/2007	John Arthur	IF there are major scope changes for the atomic physics instrument … THEN the actual cost for this instrument may be higher than our current cost estimates, and the schedule may be delayed.	Construction	**10%**	**$100**	**2**	**$10**		Mitigate	1. Adhere to the Requirements Documents (PRD, ESD, ICD, RDS). 2. Finalize scope at time of PDR (Summer 2007).	

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1.9	**Conventional Facilities**														
R-1.9-004	Tunnel Schedule	5/7/2004	David Saenz	4/11/2007	David Saenz	If the average tunneling rate, using road header boring, is not maintained … Then the minimal tunneling advances will experience a schedule delay and impact the overall schedule of beneficial occupancy milestones	Construction	**10%**	**$2,000**	**2**	**200**		Mitigate	1. Review const. secquince based on field conditions 2 - Increase working hours(days). 3 shifts 8hrs, 6/7 days week, maint. on weekends 3 - Add additional equipment. Additional muckers, robotic shotcrete machine, rockbolt jumbo 4 - Work multiple headings. Excavate/concrete UH/X-ray tunnels from both portals	
R-1.9-024	UH Tunnel Geology	8/9/2005	Dick McDonald	4/11/2007	David Saenz	IF insufficient ground cover at E. End UH tunnel for normal excavation … THEN, additional ground support will be installed to facilitate tunnel excavation	Construction	**10%**	**$250**	**2**	**25**		Mitigate	1 - Additional support has been designed by Jacobs. 2.- Install grouted canopy tubes or self drilling grouted pipe at the portal. 3 - Install shotcrete ring to incase tubes or pipe at portal. 4 - Install spiling as excavation approaches portal. 5 - Decress spacing on girders. 6 - Apply additional shotcrete	
R-1.9-025	Linac Legacy Issues	1/5/2005	Dick McDonald	4/11/2007	David Saenz	IF the condition of the existing SLAC Linac infrastructure does not support LCLS requirements … THEN the LCLS will not be able to operate the new beamlie components required to meet electron beam delivery parameters	Design, Construction	**25%**	**$750**	**2**	**187.5**		Mitigate	1. Specified utilities requirements provided to Conventional Facilities. Additional needs are continually being brought foreward and implemented. 2. Generate plan to upgrade utilities to requirements 3. Perform upgrades during 2007 shutdown 4. Eval. effective mitgating measures	
R-1.9-028	In place Utility Protection	1/23/2006	Dick McDonald	4/11/2007	David Saenz	IF SLAC operational utilities are disrupted during construction … THEN, SLAC Operations will be impacted and construction schedule will be delayed for repairs and costs will increase	Construction	**50%**	**$500**	**3**	**250**	**$250**	Mitigate	1 - Potholing 2 - Gound Penetrating radar 3 - Excavation permits 4 - Relocate utilities 5 - Put inplace contingency plan.	
R-1.9-032	CF Staff Support	2/24/2005	Dick McDonald	4/11/2007	David Saenz	IF sufficent staff are not hired in a timley manner … THEN delays will be incurred in administration of contract	Construction	**75%**	**$500**	**3**	**375**	**$375**	Mitigate	1. Identify and validate needs - Complete 2. Post position with HR. 5/14/07 will be complete 3. Contact headhunter shops. 5/29/07 will be complete 4. Search through personal contacts. - Complete	
R-1.9-033	UTR Support (CEF)	3/13/2006	Dick McDonald	4/11/2007	David Saenz	IF UTR staff are not available a timley manner … THEN UTR staff will not be sufficient to support project needs.	Construction	**25%**	**$250**	**3**	**62.5**	**$63**	Mitigate	Monitor support to insure needs are being met. - Complete Discussions have been held with CEF and plans have been put in place to support LCLS needs. 7/1/07	
R1-9-036	Turner Claim on bonds, insurance and profit	4/11/2007	Dick McDonald	5/22/2007	David Saenz	If TCCo prevails in arbitrition/litigation then LCLS is subject to additional costs	Construction	**20%**	**$4,500**	**2**	**900**		Mitigate	Review claim - On going Validate through 9/08 Process any settlement 12/08	
R1-9-037	InsituForm lets Affholder defalt on contract	5/22/2007	Dick McDonald	5/22/2007	David Saenz	If Affholder defalts then bonding company finishes contract with new contractor. Delays will be incurred until new contractor over comes learning curve and safety requirements.	Construction	**10%**	**$3,000**	**2**	**300**		Accept	Work with bonding company to minimize impact.	
R1-9-037	InsituForm sells Affholder	5/22/2007	Dick McDonald	5/22/2007	David Saenz	When Affholder is sold then there could be delays and work stopages.	Construction	**75%**	**$500**	**3**	**375**	**$375**	Mitigate	Instructr Turner to work with new owner (or remaining Affolder staff) to insure our project is given attention we need.	
											$7,460	**$1,113**			