

LARGE SYNOPTIC SURVEY TELESCOPE

Large Synoptic Survey Telescope (LSST) LSST Project Controls System Description

Kevin E. Long

LPM-98

Latest Revision June 10, 2019

This LSST document has been approved as a Content-Controlled Document. Its contents are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval. If this document is changed or superseded, the new document will retain the Handle designation shown above. The control is on the most recent digital document with this Handle in the LSST digital archive and not printed versions.



Table of Contents

- Change Record i
- 1 Introduction 1
 - 1.1 Document Purpose and Contents..... 1
 - 1.2 Organization of the LSST System Description 1
- 2 Organization..... 2
 - 2.1 Work Breakdown Structure [Guideline 1]..... 2
 - 2.2 Organizational Breakdown Structure [Guideline 2]..... 2
 - 2.3 Integrate Process [Guideline 3]..... 3
 - 2.4 Management Overhead [Guideline 4, 13] 5
 - 2.5 Control Accounts [Guideline 5]..... 6
 - 2.6 Responsibility Assignment Matrix [Guideline 3, 5]..... 6
 - 2.7 Control Account Managers (CAMs) 7
- 3 Planning, Scheduling, and Budgeting..... 7
 - 3.1 Integrated Master Schedule [Guideline 6]..... 7
 - 3.2 Performance Measurement Indicators [Guideline 7] 8
 - 3.3 Time Phased Budgets [Guideline 8, 10,11, 12] 10
 - 3.3.1 Control Accounts..... 10
 - 3.3.2 Planning Packages..... 11
 - 3.3.3 Work Packages 11
 - 3.3.4 Earned Value Techniques..... 11
 - 3.3.5 Work Authorization..... 12
 - 3.3.6 Milestone Hierarchy..... 12
 - 3.4 Budget by cost Element [Guideline 9] 13
- 4 Accounting Considerations 13
 - 4.1 Cost Accounting System [Guideline 16, 17, 18, 19] 13
 - 4.2 Labor Cost Accounting [Guideline 2.3a,d] 14

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



- 4.3 Material Cost Accounting [Guideline 2.3a,f]..... 14
- 4.4 Manufacturing 14
- 5 Analysis and Management Reports 15
 - 5.1 Project Management Calendar of Events 15
 - 5.2 Performance Measurement..... 17
 - 5.3 Schedule Status 18
 - 5.4 Actual Costs..... 28
 - 5.5 Calculate Earned Value [Guideline 22] 35
 - 5.6 Variance Analysis [Guideline 23]..... 35
 - 5.7 Indirect cost variance analysis [Guideline 2.4c]..... 36
 - 5.8 Reporting [Guideline 25, 26]..... 36
 - 5.9 Revise EAC [Guideline 27] 38
- 6 Revisions and Data Maintenance..... 39
 - 6.1 Change Control [Guideline 28, 29, 30, 31]..... 39
 - 6.1.1 Integration with Primavera [Guideline 32] 40
 - 6.1.2 Integration with Cobra [Guideline 29, 32] 40
 - 6.2 Maintenance and Archival 41

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



LSST Project Controls System Management

1 Introduction

1.1 Document Purpose and Contents

This document describes the Project Management Controls System (PMCS) used to manage and report on the health of the Large Synoptic Survey Telescope (LSST) MREFC construction project. The LSST PMCS encompasses the processes and tools that integrate and quantitatively measure project cost and schedule performance against the Performance Measurement Baseline (PMB). The PMCS is used to support the requirement to implement and maintain an Earned Value Management System (EVMS) and has been done so in a manner to be ANSI/EIA-748-C Earned Value Management Systems compliant. At this time there is no requirement to have an independent certification against ANSI/EIA-748-C.

The PMCS processes include the following:

- Organization
- Planning, Scheduling, and Budgeting
- Accounting Considerations
- Analysis and Management Reports
- Revisions and Data Maintenance

This document describes the organization of and the monthly cycle for maintaining, updating, and reporting from the interconnected PMCS systems. The details for each of the respective systems are discussed in more detail within this document, but a brief summary of each system is as follows:

- CAS – AURA Financial System
- Primavera Project Planner (V8.3) - Schedule
- Cobra (V5.1) - EVMS
- DocuShare – Document Control, Document Repository
- Drupal – LSST Change Control Board Interface
- Risk Register - Internally developed software used to manage risks and opportunities
- eCAM – Internally developed software used as the CAM's interface to all cost and schedule data

1.2 Organization of the LSST System Description

This document is organized around the 32 Guidelines comprising ANSI/EIA-748-C. Sections 2 through 6 correspond to the five ANSI/EIA-748-C guideline groups (Organization; Planning, Scheduling, and Budgeting; Accounting Considerations; Analysis and Management Reports; Revisions and Data Maintenance). Section 2 presents the project organization and integration methodology; Section 3 addresses planning, scheduling, and budgeting; Section 4 describes the accounting system; Section 5 discusses the approach to earned value analysis and reporting; Section 6 addresses change control; and Section 7 lists key reference documents. Some guidelines are not applicable to LSST and are not referenced in this document. This document supplies the details into the specific processes involved in

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



project controls and outlines the steps taken each month to manage the data listed in this document.

2 Organization

2.1 Work Breakdown Structure [Guideline 1]

The LSST WBS outlined in LPM-43 is a product-oriented, hierarchical structure that identifies the hardware, software, services, and all other deliverables required to achieve the LSST Project. The LSST WBS is the primary structure for managing performance against the PMB and is the framework for defining and assigning work, developing schedules, estimating and budgeting, and controlling changes. The WBS elements that comprise LSST control accounts are defined at level 4 but in some cases details in the IMS are at a lower level.

The WBS dictionary is a narrative attached to the WBS that describes the scope, deliverables, and associated key milestones of each work elements identified. The WBS dictionary defines each element to at least the control account level in terms of the content of the work to be performed. The WBS dictionary can be viewed through eCAM under Reports-> WBS Dictionary and is also available in LPM-44.

WBS Dictionary Report

Project Select:

WBS_SHORT_NAME	WBS_NAME	LEVEL	WBS DICTIONARY
LSST BL 15-15.01C	Project Management Office Construction	1	This WBS element includes all activities related to the management and administrationof the project. This includes quality assurance and safety, reliability, document control, cost/schedule reporting and control systems, and configuration management. The PMO is responsible for the Project Execution Plan (LPM-54) which includes defining the long-term vision and the near-term policies and procedures guiding the Large Synoptic Survey Telescope (LSST) project through design & development, construction, and into Operation. The PMO is responsible for meeting Federal and non-Federal Sponsor expectations for the construction; provide maximum transparency into the levels and types of effort required to meet the project&C's goals, and inform and hold accountable LSST team members throughout the project&C's various work elements.
LSST BL 15-15.01C.00	PMO Level 2 Milestones	2	This WBS Element defines the Level 2 milestones for this project. These milestones are used to capture milestones that impact other level 1 subsystems.
LSST BL 15-15.01C.01	LSST Project Office	2	This WBS element includes the efforts of the Project Management Office that inclde specifically the offices for the Project Director and Project Manager. The effort includes management of the LSST schedules, budgets, plans, organization, procedures, policies, partnering, and resources, including: <ul style="list-style-type: none"> - Management and Administration of the Project Management and Control System (PMCS) - Managing the LSST Headquarters physical assets (hardware, software, facilities, documents) during the Construction Phase, as well as preparing for the same activities during the Operations Phase. - Managing software and document repositories - Control, Storage, and Distribution of all Project Documentation including Technical Publications, Management Letters and Memoranda, Contract Documentation, Drawings, Graphics, Presentations, Administrative Support Personnel, Supplies, and Communications. - Procuring, configuring, administering, and maintaining computing, communications and storage infrastructure documentation library (developmental and production configurations) - Configuration control and asset management for all physical assets

Figure 2.1 WBS Dictionary as reported from eCAM

2.2 Organizational Breakdown Structure [Guideline 2]

The LSST Organizational Breakdown Structure (OBS) is a hierarchical structure that describes the established organizational framework for project planning and resource management within the project. The OBS identifies the accountability, responsibility, management, and approvals of all authorized work scope. The LSST OBS has been grouped by LSST major subawards where the source institutions resource

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.

and rate structure has been integrated into the LSST toolset.



+ 1.01 LSST
+ 1.02 SLAC
+ 1.03 IPAC
+ 1.04 NCSA
+ 1.05 UW
+ 1.06 Princeton
+ 1.07 NOAO
+ 1.08 Adler
+ 1.09 UCD
+ 1.14 Purdue

Figure 1.2 LSST OBS Structure

2.3 Integrate Process [Guideline 3]

The time-phased budget which defines all scope to be executed for the LSST MREFC construction is built and maintained in the IMS. The IMS is a logic-based schedule that is organized by WBS and tasks are logically linked to create a networked schedule. This schedule network is used to measure and report progress towards project milestones and the detailed tasks necessary to achieve those milestones.

The enhancement and detailing of the IMS is subject to configuration control and is an iterative process that is fully documented through LCRs. LCRs are created using the LSST change control system and are typically initiated by the CAMs or SMEs. As design and details and bottoms up cost estimates from vendors mature, higher level schedule visibility tasks and planning packages are manipulated to represent a higher fidelity of the work to be performed, and the resources necessary to accomplish the work. These detailed plans are integrated into the IMS and reconciled with downstream summary level activities and concurrent scope. As a result of this the near term schedule exhibits higher quantities of shorter duration tasks and more frequent milestones than scope that is further out in time, a common artifact of rolling wave planning.

Notebook fields are used in the IMS to detail the Statement of Work and the Basis of estimate used to establish the time-phased budgets defined in the plan.

WBS	Activity ID	Activity Name	Institution	CAM	Cobra WBS	OBS	Cobra WP	EVT	Start	Finish	
LSST ME 15-12.02C.06.02 Data Access Services										01-Aug-14 A	31-Aug-20
	LSST ME 15-12.02C.06.02.04	DMTC-3900-0500	Image and File Services R7.0	SLAC	Becla J	1.02C.06.02	1.02	KLM20602A.PP	K	01-Sep-16	28-Feb-17
	LSST ME 15-12.02C.06.02.04	DMTC-3900-0600	Image and File Services R8.0	SLAC	Becla J	1.02C.06.02	1.02	KLM20602A.PP	K	01-Sep-17	28-Feb-18

General	Status	Resources	Relationships	Codes	Notebook	Steps	Feedback	VPs & Docs	Expenses	Summary
Activity DMTC-3900-0500 Image and File Services R7.0										
<p>Statement of Work</p> <p>Activity Scope:</p> <p>Full capability, all use cases/activities. Maintain and Enhance</p> <p>This activity includes a major release at 6 months. This is followed by QA of that release, defect removal and performance tuning, and a minor release at 11 months.</p> <p>Scope includes the Use Cases/Activities from the UML Model (LDM-133, LDM-134, LDM-146) in this WBS.</p> <p>Program and debug the software using project-approved tools and languages, per https://dev.lsstcorp.org/trac/wiki/SwStandards.</p> <p>Earned value is based on detailed steps and is expanded in the "rolling wave" plan developed in the predecessor "Scope and Plan" activity.</p>										

Figure 2.3a Example Statement of Work defined in the IMS

The EVMS links the technical, schedule, and cost elements of the projects using the WBS, OBS, and a variety of embedded code structures. Establishment of these unique code structures facilitates the linkage between planning, scheduling, budgeting, work authorization, actual cost accumulation, risk management, and performance measurement as shown below

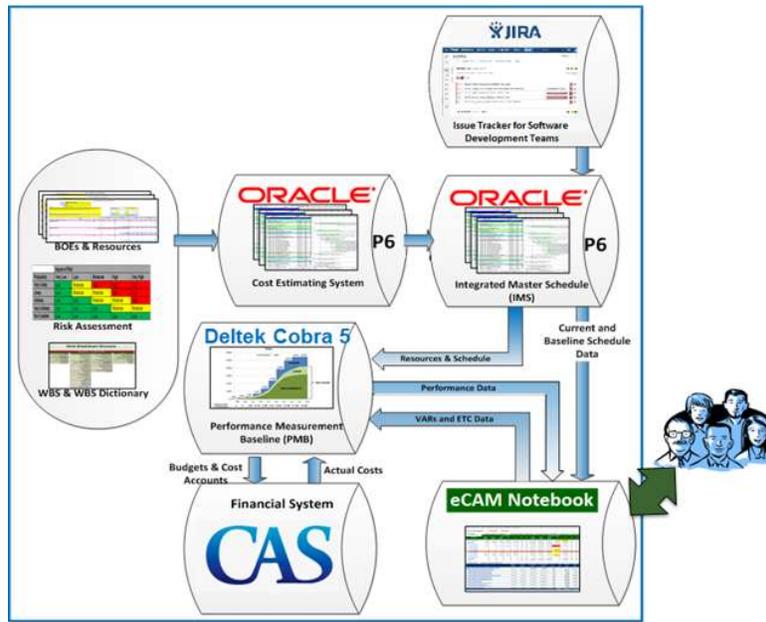


Figure 2.3b Integration of Technical, Cost, and Schedule

All budget loaded activities in the IMS are assigned codes which allow integration with the Cobra. These key fields for Cobra integration include the following fields; Cobra WBS, Cobra WP, OBS, CAM, and EVT.



Layout: PMCS Cobra Code Fields		Filter: All Activities						
WBS	Activity ID	Activity Name	Institution	CAM	Cobra WBS	OBS	Cobra WP	EVT
LSST ME 15-12.02C.06.02 Data Access Services								
	LSST ME 15-12.02C.06.02.04	DMTC-3800-0500	Image and File Services R7.0	SLAC	Becla J	1.02C.06.02	1.02	KLM20602A.PP K
	LSST ME 15-12.02C.06.02.04	DMTC-3800-0600	Image and File Services R8.0	SLAC	Becla J	1.02C.06.02	1.02	KLM20602A.PP K
	LSST ME 15-12.02C.06.02.04	DMTC-3800-0700	Image and File Services R9.0	SLAC	Becla J	1.02C.06.02	1.02	KLM20602A.PP K
	LSST ME 15-12.02C.06.02.04	DMTC-3800-0800	Image and File Services R10.0	SLAC	Becla J	1.02C.06.02	1.02	KLM20602A.PP K

Figure 2.3 PMCS Cobra Code Fields Layout in Primavera

Many other activity codes and user defined fields are used to enable us to interrogate the schedule to produce useful management reports and organized views to digest schedule data.

2.4 Management Overhead [Guideline 4, 13]

LPM-81 defines the processes and methodologies used to expose visibility into direct and indirect costs of the project. The Labor indirect costs differ institution by institution and have been accounted for in the rate sets used in Primavera and the Resource Breakdown Structure in Cobra.

PricingGroup	Fringe	Labor Indirect	Non-Labor Indirect	Materials Indirect	Travel Indirect	Contract Indirect	Indirect Cap	Institutions
LSSTC	38.37%	2.67%	2.67%		2.67%	2.67%	25,000.00	LSSTC
NOAO	38.37%	2.67%	2.67%		2.67%	2.67%	25,000.00	NOAO
IPAC	29.50%	80.10%	NA	NA	NA	NA	-	IPAC
NCSA	42.94%	58.60%	NA	NA	NA	NA	-	NCSA
PRINCETON	34.40%	62.00%	NA	NA	NA	NA	-	PRINCETON
SLAC	57.50%	3.00%	NA	NA	NA	NA	-	SLAC
UCD	48.30%	55.50%	NA	NA	NA	NA	-	UCDAVIS
UW	35.30%	54.50%	NA	NA	NA	NA	-	UW

Figure 2.4 Indirect costs by Institution

The Integration from Primavera to Cobra is done by hours for labor resources and budgeted units for nonlabor. The Indirect rates in the table above are assigned to the appropriate resource and result in Cobra to calculate the total cost for each resource assignment. This result structure in Cobra allows budget reporting by direct, fringe, indirect, and escalation results independently.

Resource	Description	Fast Lane Code	Resource Type	CAS Codes
PMCS Resources	Resources		0	
PMCS Contracts	PMCS Contracts		NonLabor	
PMCS Labor	PMCS Labor		Labor	010
LSSTC Labor	LSSTC Labor	B2	Labor	010
LAD-LSSTC	Direct Administrator-LSSTC	B5	Labor	010
LEEN-LSSTC	Electrical Engineer-LSSTC	B2	Labor	010
LEN-LSSTC	Engineer-LSSTC	B2	Labor	010
LGR-LSSTC	Graduate Student-LSSTC	B3	Labor	010

Field Name	Result	Units	Rate Set	Currency
HOURS	HOURS	HOURS		
FTE	FTE	FTE	FTE	
DIRECT	DIRECT	\$	LAD-LSSTC	
FRINGE	FRINGE	\$	LSSTC-Fringe	
INDIRECT	INDIRECT	\$	LSSTC-Labor-Ind	
ESC	ESC	\$	EscEngineering	

(DIRECT) * (Rate) = FRINGE

Figure 2.4a Cobra build-up of resource calculations

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.

2.5 Control Accounts [Guideline 5]

A control account is a management control point at which budgets (time-phased resource plans) and actual costs are summarized and compared to earned value for management control purposes. A control account is a natural management point for planning and control since it represents the work assigned to one responsible organizational entity for a single program WBS element. A control account manager maintains responsibility for an individual control account and all technical, cost, and schedule elements in work Packages below it.

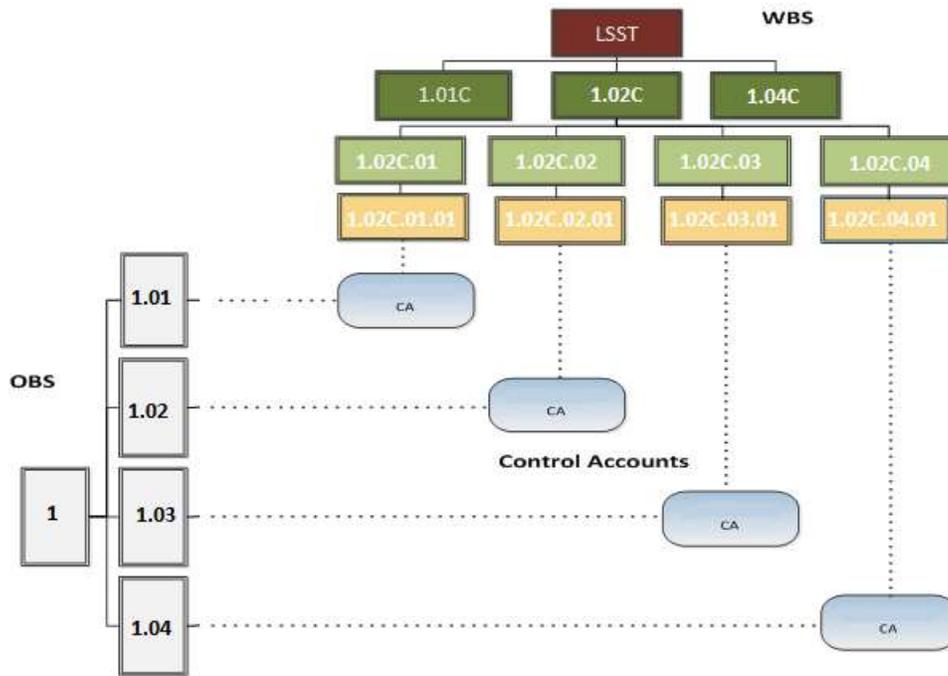


Figure 2.5 Graphical Representation of Control Accounts

2.6 Responsibility Assignment Matrix [Guideline 3, 5]

The Responsibility Assignment Matrix (RAM) is a key project document that links deliverables to resources. The RAM is created by integrating the organizational breakdown structure with the work breakdown structure. Intersection points between the WBS and OBS define where Control Accounts will be created and the associated BAC. At each Control Account a single Control Account manager (CAM) is assigned and is responsible for the cost, Schedule, and technical scope associated within. The RAM can be viewed through eCAM under Reports-> RAM. This report allows filtering by CAM and shows not only the BAC for the control account but also ACWP, BCWP, and BCWS.



		1.01 LSST	1.02 SLAC	1.03 IPAC	1.04 NCSA	1.05 UW	1.06 Princeton	1.07 NOAO	1.08 Adler	1.09 UCD	1.10 Arcadis	1.11 UA	1.13 RAL	1.14 Purdue	1.15 PFLOW	Grand Total
1.01C.01.01 LSST Project Office	ACWP	\$2,324,959														\$2,324,959
	BAC	\$17,268,498														\$17,268,498
	BCWP	\$2,233,385														\$2,233,385
	BCWS	\$2,233,347														\$2,233,347
1.01C.01.02 Chief Scientist Support	ACWP									\$99,008						\$99,008
	BAC									\$1,725,071						\$1,725,071
	BCWP									\$236,852						\$236,852
	BCWS									\$236,863						\$236,863
1.01C.01.03 Communications	ACWP	\$235,297														\$235,297
	BAC	\$2,110,345														\$2,110,345
	BCWP	\$428,844														\$428,844
	BCWS	\$428,864														\$428,864

Figure 2.6 RAM as available from eCAM

2.7 Control Account Managers (CAMs)

The LSST CAMs are responsible for the planning and management of the technical scope, schedule, and budget for assigned control accounts. They will provide timely input to the Project Manager in the formats described in this plan and will keep the project management staff informed of their work progress and issues or concerns, risk assessment, tracking methods, variance analysis, and ETC/EAC management processes.

3 Planning, Scheduling, and Budgeting

3.1 Integrated Master Schedule [Guideline 6]

The Integrated Master Schedule (IMS) is a network of tasks linked from program start through program finish, reflecting the interdependencies between tasks and milestones. The IMS is the foundation of the performance measurement baseline (PMB) used to track progress, forecasts, and changes throughout program execution. The IMS enables the Critical Path Method that is used to identify the program critical path, as well as driving paths to major interim events or deliverables.

The IMS is subject to configuration control as part of the baseline. The change control process ensures that elements of the IMS, PMB, and technical baseline are kept synchronized. The schedule is baselined, and status is input in the scheduling tool (P6). The time-phased work packages are identified and used to build the planned value (PV) profiles in the PMB and the schedule status drives the EV reporting against PV based on physical percent complete and milestone completions.

Critical Milestones are defined as Level 1 milestones (NSF reporting) and are watched and reported on monthly in the LSST monthly construction report. Level 2 milestones are coded to be managed at the project level, and Level 3 and 4 are watched at the WBS subsystem and CAM levels respectively.

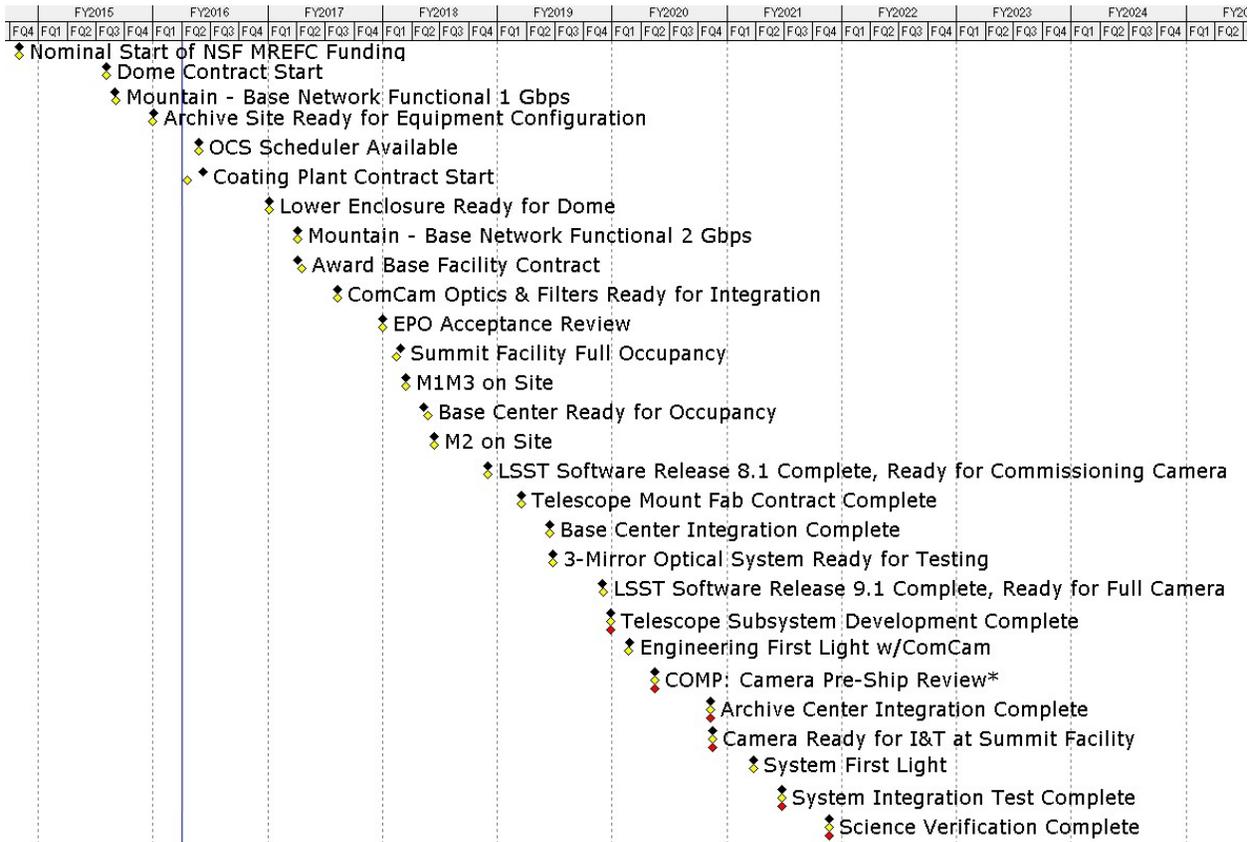


Figure 3.1 Level 1 Milestones

3.2 Performance Measurement Indicators [Guideline 7]

Current progress at the task level is collected monthly from each CAM and compared to the baseline for schedule performance analysis. Project progress and milestone completion status are maintained on the forecast schedule defined with a naming convention of “LSST ME YY-MM”. The baseline schedule “LSST BL YY-MM” remains without status for clean integration into Cobra. The Primavera EPS is used to differentiate between forecast and baseline schedules.



LSST-CCM		LSST Construction and Commissioni	Read Only Access
LSST ME 15-12	LSST December 2015 Month End Forecast		Read Only Access
Baseline		LSST Monthly Baselines	Read Only Access
LSST BL 14-08	LSST August 2014 Month End Baseline		Read Only Access
LSST BL 14-09	LSST September 2014 Month End Baseline		Read Only Access
LSST BL 14-10	LSST October 2014 Month End Baseline		Read Only Access
LSST BL 14-11	LSST November 2014 Month End Baseline		Read Only Access
LSST BL 14-12	LSST December 2014 Month End Baseline		Read Only Access
LSST BL 15-01	LSST January 2015 Month End Baseline		Read Only Access
LSST BL 15-02	LSST February 2015 Month End Baseline		Read Only Access
LSST BL 15-03	LSST March 2015 Month End Baseline		Read Only Access
LSST BL 15-04	LSST April 2015 Month End Baseline		Read Only Access
LSST BL 15-05	LSST May 2015 Month End Baseline		Read Only Access
LSST BL 15-06	LSST June 2015 Month End Baseline		Read Only Access
LSST BL 15-07	LSST July 2015 Month End Baseline		Read Only Access
LSST BL 15-08	LSST August 2015 Month End Baseline		Read Only Access
LSST BL 15-09	LSST September 2015 Month End Baseline		Read Only Access
LSST BL 15-10	LSST October 2015 Month End Baseline		Read Only Access
LSST BL 15-11	LSST November 2015 Month End Baseline		Read Only Access
LSST BL 15-12	LSST December 2015 Month End Baseline		Read Only Access
LSST BL 16-01	LSST January 2016 Month End Baseline		Read Only Access
LSST BL 16-02	LSST February 2016 Month End Baseline		Read Only Access
Forecast		LSST Monthly Forecasts	Read Only Access
LSST ME 14-08	LSST August 2014 2014 Month End Forecast		Read Only Access
LSST ME 14-09	LSST September 2014 Month End Forecast		Read Only Access
LSST ME 14-10	LSST October 2014 Month End Forecast		Read Only Access
LSST ME 14-11	LSST November 2014 Month End Forecast		Read Only Access
LSST ME 14-12	LSST December 2014 Month End Forecast		Read Only Access
LSST ME 15-01	LSST January 2015 Month End Forecast		Read Only Access
LSST ME 15-02	LSST February 2015 Month End Forecast		Read Only Access

Figure 3.2 Primavera Baseline and Forecast EPS nodes

Most contracts have provisions that require them to develop a schedule or a schedule of values that supports the details in the project schedule. The control account managers are responsible for ensuring that the methods used to give status on these schedules result in an objective measurement of progress in the LSST forecast.

On at least a monthly basis each control account manager works with project controls to determine the status of the remaining and in-progress activities and updates the schedule status including:

- Actual start dates for activities/milestones started in the current status period.
- Actual finish dates for activities/milestones completed in the current status period.
- Physical percent complete of activities started but not complete.

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.

- Forecasted finish dates for activities previously started but not yet completed.

The Primavera project is set to automatically calculate the % complete based on activity steps. For activities that don't use steps, project controls manually input a % complete for each activity based on CAM inputs. Any milestone that is completed will also have an associated step called "Completed" and will be marked as complete, so the milestone shows 100% complete in reporting. The current and baseline schedules are then compared and analyzed to determine the extent to which the project is ahead of or behind schedule. This comparison also identifies the specific activities that drive current SVs focusing on those areas of greatest impact on, or potential risk to, key milestones and project completion.

Activities that are resource loaded and have a duration of greater than 2 months are greatly encouraged to have at least 2 weighted activity steps on them in order to quantifiably measure performance. The weighting factor can be dollars, hours, duration, or any other measurement tool as long as it is weighted relatively across all the steps assigned to that activity. The software teams integrating Jira with Primavera use story points as their basis for step weights. For most teams, 1 story point is equal to 4 hours.

General	Status	Resources	Relationships	Codes	Notebook	Steps	Feedback	WPs & Docs	Expenses	Summary	
						Activity	DM-1991		Refactor Approximate and Interpolate classes		
Step Name	Step Weight	Completed									
DM-3214 ChebyshevBoundedField should use <code>_not_</code> as field separators for persistence	1.0	<input checked="" type="checkbox"/>									
DM-2865 Merge BoundedField from HSC as is	2.0	<input checked="" type="checkbox"/>									
DM-2477 Design API and RFC design	8.0	<input checked="" type="checkbox"/>									
DM-2479 Fix-up any code that uses approximate/interpolate	4.0	<input type="checkbox"/>									
DM-2480 Delete old approximate/interpolate classes	2.0	<input type="checkbox"/>									
DM-2478 Edit background class	10.0	<input type="checkbox"/>									
DM-740 Implement abstract base class for approximated or interpolated fields	10.0	<input type="checkbox"/>									

Figure 3.2a Stories assigned to a Jira Epic for Performance Measurement

Many Activities in the IMS are associated with payment milestones developed by collaboration between the contractor and the LSST CAM. These payment milestones are tracked and status is set monthly by receiving updated schedules, or excel lists of these milestones and their % complete.

3.3 Time Phased Budgets [Guideline 8, 10, 11, 12]

The assignment of budgets to scheduled activities in the IMS produces a budget plan against which actual performance can be measured. This is called the Performance Measurement Baseline (PMB) and is integrated into Cobra. The Integrated budget into Cobra is defined as the Budget at Completion (BAC) and is subdivided into control accounts, planning packages, and work packages.

3.3.1 Control Accounts

Control Accounts are a management control point in the WBS where scope, cost and schedule are aggregated and compared to earned value for performance measurement. A responsible individual (a CAM) is assigned to each Control Account in the RAM. Within a Control Account the sum of the Work Packages and Planning Packages equals the Control Account budget.



3.3.2 Planning Packages

LSST Planning Packages are defined at the level directly under the Control Account and specifies what work is planned. Planning Packages are reserved for future activities that cannot be clearly defined when the project baseline is set. Work that is beyond the current detailed planning period will reside in planning packages until they are converted to detailed work plans per a rolling wave process. The Planning Packages consist of a work scope, schedule, and time-phased budget normally at a higher level than individual Work Packages. Planning Packages do not require the detail found in Work Packages since, by definition, such details are not known. The LSST eCAM system alerts the team 6 months prior to a Planning Package start date with a yellow indicator, which turns to red 3 months prior to the start date if it hasn't been detail planned. The detail planning involves splitting the planning package into smaller activities and assigning the appropriate resource IDs that will be working those activities. For elements that have a non labor component costs are reevaluated by getting updated vendor quotes from vendors. The existing activity(s) that are being converted to detailed activities have their PMT Cobra code changed from K - (planning package) to C – (Percent Complete). If the entire planning package isn't being converted the duration of the planning package is decreased to the appropriate amount and is linked to the last activity that was detailed.

3.3.3 Work Packages

LSST Work Packages are defined at the level directly under the Control Account and specifies what work is planned, measures progress on that work, and computes the associated earned value. Actuals for LSST will be aggregated and loaded at the work package level. The IMS consists of resource loaded activities which roll up to represent the total dollars and hours assigned to the Work Packages. If changes need to be made to the baseline resulting from rolling wave planning, a LCR will be prepared and submitted for management review and approval. Work Packages are configured using the following criteria:

- Has a limited duration within a reasonably short time span
- Has scheduled start and completion dates
- Has resource requirement separated (e.g., labor, material, contracts) in a way that allows the EV reporting process to accurately measure progress
- Has a budget or an assigned value expressed in hours and/or dollars
- Reflects the way in which work is conducted and has meaningful work products
- Has a one to one correlation to an accounting charge number in CAS
- Uses a single EV method

3.3.4 Earned Value Techniques

Each established work package will have one corresponding Earned Value Technique (EVT). The following EVTs and their associated Cobra codes are used by LSST:

- A – Level of Effort
 - This EVT assumes that when a work package starts, its progress will not deviate from the original budget spread. There are no limitations upon the applicability of this technique for measuring progress, but it is most suitable for only a small number of work packages



that are by their nature unmeasurable. By definition, the value earned by an open work package using this EVT is equal to its to-date budget. The value earned each period equals the budget.

- C - Percent Complete
 - Used to manually enter the completion status of the work package in percent each status period. When using method C the subordinate tasks in the schedule should have associated activity steps to help quantify the work performed.
- K – Planning Package
 - This EVT results in always calculating an earned value of zero for the item. Use this EVT if one does not want the work package to earn any of its budget, regardless of its status.

3.3.5 Work Authorization

The authorization of work on a project ensures that control and accountability are maintained. All project work must be authorized before it can commence. When the project baseline is set, project work is authorized by the PM and is formally communicated to the responsible CAM via the available BAC in the eCAM notebook.

WBS / WP	Current Period								Cumulative to Date								At Complete	
	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	BAC	EAC		
1	\$29,257	\$29,230	\$22,161	(\$28)	\$7,069	1.00	1.32	\$471,104	\$471,119	\$244,982	\$15	\$226,137	1.00	1.92	\$2,737,740	\$2,511,604		
1.01C	\$29,257	\$29,230	\$22,161	(\$28)	\$7,069	1.00	1.32	\$471,104	\$471,119	\$244,982	\$15	\$226,137	1.00	1.92	\$2,737,740	\$2,511,604		
1.01C.03	\$29,257	\$29,230	\$22,161	(\$28)	\$7,069	1.00	1.32	\$471,104	\$471,119	\$244,982	\$15	\$226,137	1.00	1.92	\$2,737,740	\$2,511,604		
1.01C.03.01	\$29,257	\$29,230	\$22,161	(\$28)	\$7,069	1.00	1.32	\$471,104	\$471,119	\$244,982	\$15	\$226,137	1.00	1.92	\$2,737,740	\$2,511,604		
KLM10301A.LABOR	\$19,976	\$19,976	\$18,798	\$0	\$1,178	1.00	1.06	\$307,422	\$307,422	\$178,935	\$0	\$128,487	1.00	1.72	\$1,858,317	\$1,729,830		
KLM10301A.PROC	\$2,786	\$2,781	\$2,273	(\$5)	\$509	1.00	1.22	\$8,359	\$8,366	\$44,989	\$7	(\$36,623)	1.00	0.19	\$219,005	\$255,628		
KLM10301A.TMS	\$6,495	\$6,472	\$1,090	(\$23)	\$5,382	1.00	5.94	\$155,323	\$155,330	\$21,057	\$7	\$134,273	1.00	7.38	\$660,419	\$526,146		

Figure 3.3.5 Published budget from eCAM

The work authorization process ties directly to the CCB process and includes management approval and documentation of the expenditure of project budget and the allocated work packages and resource hours to accomplish a specified scope of work within the agreed to budget, schedule, and technical objectives. Once the cost accounts and budgets are baselined and available in eCAM, the CAMs are authorized to proceed with their allocated work. Part of the authorization of work is also the acceptance of that work by the CAM. The acceptance of assigned work by all parties represents a multilateral commitment to authorize and manage the work within the budget and agreed-upon schedule for the required scope. The CAM will further authorize the needed team members to commence work via the establishment of work orders and additional purchase requisitions in CAS. Once the work is completed, the CAM will notify Project Controls and Business Support that the work packages and cost accounts should be closed.

3.3.6 Milestone Hierarchy

The Project Milestones are in the IMS and their definitions and planned dates are mutually developed by LSST, SLAC, and the National Science Foundation and documented in the Milestone Dictionary. These milestones are tracked as part of the monthly status cycle of the IMS.

The milestone level in the hierarchy indicates milestone ownership and approval authority. As the milestone hierarchy flows from top to bottom, the milestones in each level are defined in support of the



next higher-level milestones. For example, Level 2 milestones are defined in support of meeting the Level 1 milestones. The eCAM notebook provides views to track all LSST milestones in a hallway summary display and a list that can be filtered by CAM, WBS, milestone level, and date.

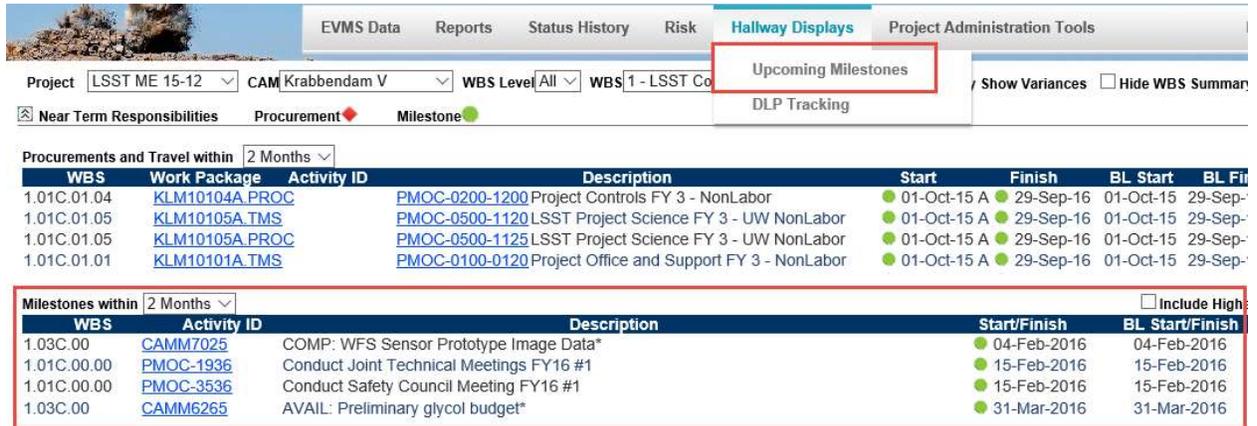


Figure 3.3.6 eCAM milestone view

3.4 Budget by cost Element [Guideline 9]

LSST work packages are created and named by the planned cost elements as defined by the CAS accounting structure. The work package name consists of a 10 character code (KLM + 4 level WBS) followed by the cost element type of .LABOR, .PROC, or .TMS. This structure follows the following convention

- .LABOR is associated with LSST or NOAO direct labor and is categorized under the .0## CAS accounting code
- .PROC is associated with a large contract or procurement categorized under the .7## CAS accounting code
- .TMS is associated with Travel, Materials, or Supplies and is categorized under all other CAS accounting codes.

4 Accounting Considerations

4.1 Cost Accounting System [Guideline 16, 17, 18, 19]

LSST utilizes the AURA financial system (CAS) for project cost accounting. Cost accounting is authorized for work packages and their associated work Packages when the LCR for the assigned budget is approved. Since work Packages are defined at a summarized cost element level, it is possible to have up to three work packages associated to one charge number in CAS. All direct labor, material, procurement contracts, and other direct costs are accumulated against the work package by cost element. The list of cost elements is exhaustive, and the details are preserved when loading into Cobra.

All costs reported in the accounting system are transferred into Cobra by work package. Project work



packages are closed when the work is complete and all costs have cleared. Once the actual costs are in Cobra, WBS and OBS codes in Cobra allow the cost to be summarized through both the WBS and OBS structures without allocating an account to more than one WBS or OBS element.

CAS typically closes for the previous month on the third week of the following month (if the reporting month is January accounting will close February 23rd). Data is exported from the CAS system via an Excel file and includes cumulative to date actuals for the fiscal year being interrogated. This data is loaded into a “Acutal Processor” tool which summarizes the details by Work Package, resource, and total cost and merges this data with previous fiscal years data. This data is saved as a CSV file and the source of information used to import actuals into Cobra.

Indirect costs are defined at the CAS Cost Element level and are visible in Cobra and eCAM for analysis to CAMs.

☒ Time Phased Data Selected Work Package: KLM10101A.LABOR

Calendar: Cobra Cost Class:

Resource	Class	Total	08/14	09/14	10/14	11/14	12/14	01/15	02/15	03/15	04/15	05/15	06/15	07/15	08/15	09/15
Payroll & Full Benefits	Actual	\$1,320,562	\$0	\$30,363	\$79,115	\$144,953	\$-16,991	\$65,032	\$71,071	\$72,114	\$72,114	\$113,608	\$90,631	\$87,849	\$89,936	\$111,038
Special Payrolls	Actual	\$-9,684	\$0	\$0	\$0	\$0	\$337	\$0	\$0	\$0	\$0	\$0	\$190	\$0	\$0	\$-16,230
Overtime & Benefits	Actual	\$-51	\$0	\$0	\$-92	\$-92	\$134	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Chile Payroll	Actual	\$36,210	\$0	\$0	\$-674	\$2,504	\$3,841	\$3,074	\$2,131	\$6,817	\$2,269	\$2,189	\$2,133	\$2,079	\$2,077	\$2,149
Chile Overtime	Actual	\$971	\$0	\$0	\$49	\$208	\$-36	\$26	\$0	\$178	\$491	\$27	\$26	\$0	\$0	\$0
Chile Payroll Expense	Actual	\$1,078	\$0	\$0	\$84	\$178	\$7	\$90	\$63	\$68	\$93	\$65	\$64	\$61	\$61	\$64
Chile Servicio de Bienestar	Actual	\$783	\$0	\$0	\$56	\$112	\$-2	\$52	\$53	\$53	\$55	\$54	\$53	\$52	\$48	\$48
Net Labor Recharge - Intrafund	Actual	\$-138,504	\$0	\$0	\$-35,044	\$-15,913	\$-2,506	\$-3,429	\$-6,784	\$-7,558	\$-7,078	\$-5,402	\$-7,477	\$-7,271	\$-3,941	\$-6,129
Net Labor Recharge - LSST	Actual	\$24,366	\$0	\$0	\$-2,813	\$2,705	\$2,931	\$4,076	\$3,466	\$3,179	\$1,679	\$736	\$1,648	\$-125	\$2,018	\$1,353
Net Labor Recharges	Actual	\$-283	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$-131	\$0	\$-37	\$0	\$0
Grand Total		\$1,235,449	\$0	\$30,363	\$40,681	\$134,655	\$-12,284	\$68,922	\$70,000	\$74,851	\$69,624	\$111,147	\$87,269	\$82,608	\$90,200	\$92,293

Figure 4.1 Example breakout of Actuals by Cost Element in eCAM

4.2 Labor Cost Accounting [Guideline 2.3a,d]

Labor cost (salary+fringes+overhead) is allocated to the cost accounts in accordance with the ‘fractions’ of effort that an employee spends supporting each account (monthly or biweekly depending on employee category). The fractions are determined from effort recorded in the CAS timecard system. The effort approval requires the direct supervisor review and approve their time card on a bi-weekly basis for all AURA employees. For contracted work LSST receives monthly invoices with the labor hours indicated. Each invoice has a project technical review as well as a contracts department review.

4.3 Material Cost Accounting [Guideline 2.3a,f]

Major procurements will be planned and implemented (i.e., in Primavera and Cobra) as one or more work packages representing a logical portion of the effort so that the EV metrics accurately reflect the time phasing of equipment and material receipts. Credit for Earned Value will be taken after the equipment or material has been accepted by the CAM.

4.4 Manufacturing

LSST does not identify or track unit costs, equivalent unit costs, or lot costs for the purposes of Earned Value. For elements that have a manufacturing element, the Planned Value of the activity is based on estimates from the SME(s) and Earned Value is tracked using Activity Steps in Primavera with the



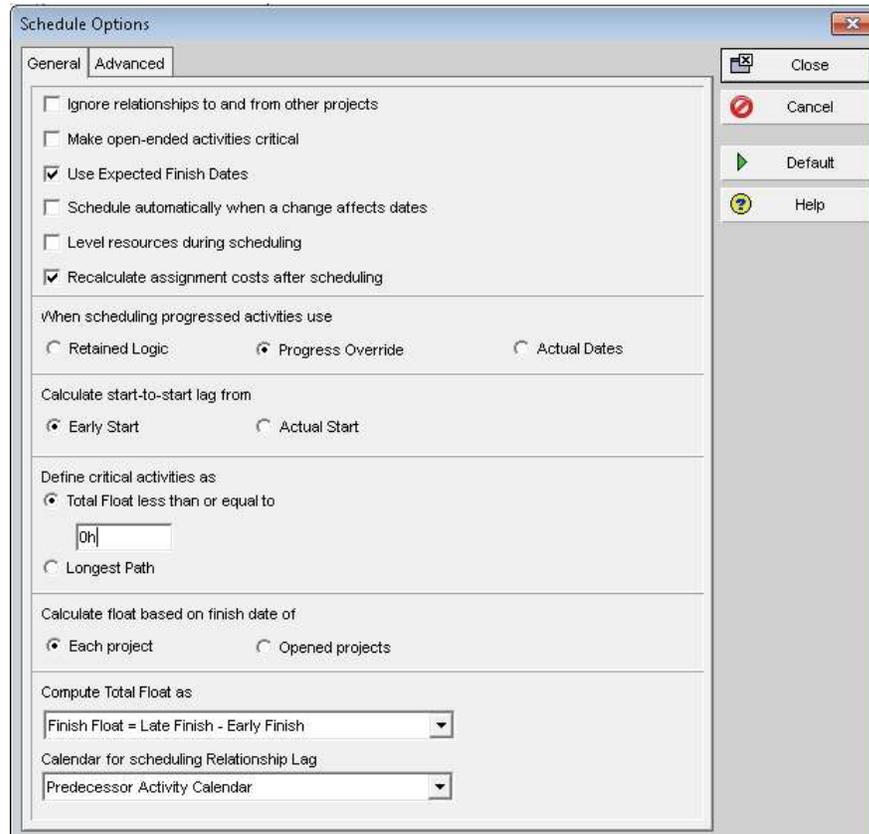
appropriate total quantity as the weighting factor on the activity. For example, if 100 units will be manufactured there will be two activities for the Labor and nonlabor components of those units. Each activity will have the total costs for each resource type in hours/and or dollars. Each activity can use activity steps to measure the performance of the effort.

5 Analysis and Management Reports

5.1 Project Management Calendar of Events

The Project Controls team will use a defined calendar to follow a regimented cycle in maintaining the PMB and reporting project progress and costs.

- First week of the month
 - All approved change requests from the previous month should be implemented in the Baseline schedule, forecast schedule, and Cobra.
 - All status should be entered into Jira by the first Friday of the month. All other status inputs are collected either by contractor schedule updates, milestone status update sheets, or manually by project controls meeting with the CAM one on one.
 - Project controls validates all provided status inputs. These validations check for out of sequence work, valid percent completes, actual dates, and forecast completion dates. Anomalies will be submitted back to the CAM for review and resubmission.
 - Data date in Primavera is advanced to the first day of the next month, and status is calculated in the schedule. LSST uses the following scheduling options in Primavera.



- Second week of the Month
 - Receive SLAC Camera milestone updates and manually enter into the camera schedule milestones.
 - Schedule the project again to recalculate forecast dates. Feedback LSST milestones that SLAC is tracking to SLAC in Excel format. Resolve any issues with updated camera milestone dates with SLAC.
- Third week of the month
 - Pull actuals from CAS when available.
 - Advance the calendar in Cobra.
 - Create a new Cobra project based on the previous month's data and integrate schedule status and actual costs.
 - Publish data in eCAM and alert CAMs to updated data.
 - CAMs write variance narratives where appropriate
 - Create a copy of the baseline schedule and Cobra projects to begin prepping next month's data. Begin Implementation of all approved LCRs into the copy of the baseline schedule, forecast schedule, and Cobra.

- Create drafts of all EV and schedule reports and review with management.
- Last week of the month
 - Publish final EV and schedule reports to Docushare.
 - Complete implementation of all LCRs by the end of the month.
 - LCR Contingency/UB/DB log updated and posted to Docushare.

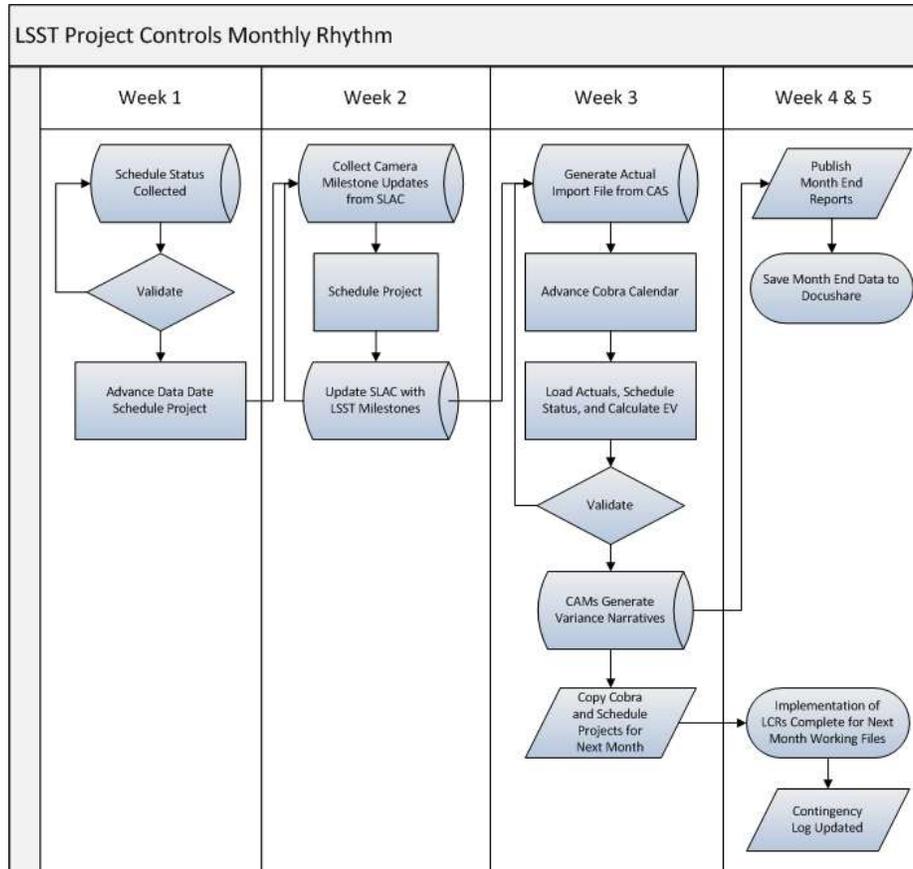


Figure 5.1 Project Controls Battle Rhythm

5.2 Performance Measurement

Performance is measured monthly in terms of actual cost, schedule (milestones and task completions), and EV. EV is expressed in the same units as planned value using established performance measurement methods assigned to work packages. Once a work package is opened, the measurement technique is not allowed to be changed. EV is compared to PV and actual costs for determining schedule and cost variances. All three metrics (EV, PV, AC) are rolled up through the WBS and/or OBS structures providing performance measures for each level of the hierarchy.

Earned value is calculated consistent with the DOE G 413.3-10 Gold Card as shown below.

- **Planned Value (PV).** The approved time-phased budget plan is the PV function for a control account. The PV for a control account is typically developed at a lower level of detail (e.g., for each work package) and rolled up. PV is also referred to as Budgeted Cost of Work Scheduled (BCWS).
- **Earned Value (EV).** A measurement of the work completed. The EV is also referred to as the Budgeted Cost of Work Performed (BCWP), and is derived by applying pre-determined EV calculations to assess the work completed for each in-process work package.
- **Schedule Variance (SV).** $SV = EV - PV$ (positive indicates ahead of plan). Care is exercised in drawing conclusions from favorable or unfavorable SVs because of the influence of high-value work performed out of sequence. A negative SV must also be considered in conjunction with critical path analysis to determine what the significance of a variance is. It must also be examined along with the CV (below) in order to determine if the rate of progress is consistent (or not) with the resources used.
- **Actual Cost (AC).** The AC is the cost for work that has been completed or partially completed (actual cost plus accruals). The AC is compiled in the CAS financial management system by control account. Accruals are included as 'used cost' in the accounting system according to the accrual process defined in the Finance Manual Section 5, Accrued Costs.
- **Cost Variance (CV).** $CV = EV - AC$ (positive indicates favorable). Care is exercised in drawing conclusions from favorable or unfavorable CVs because of the influence of high-value work performed out of sequence. A negative CV must also be considered in conjunction with the SV (above) in order to determine if the cost is consistent (or not) with the schedule accomplished.
- **Estimate to Complete (ETC).** The ETC is the latest revised estimate for the remaining work scope. ETCs are developed for the remaining scope annually.
- **Estimate at Completion (EAC).** $EAC = AC + ETC$.
- **Budget at Completion (BAC).** The BAC is the total budget for a given work scope. Lower level budgets for work packages and planning packages are rolled up to the project BAC. The BAC for the total project plus contingency/MR equals the total project cost (TPC).
- **Variance at Completion (VAC).** When the EAC is subtracted from the BAC, a measure of the VAC is obtained ($BAC - EAC = VAC$). The VAC is the amount of under-run or over-run forecast for the scope of work.

5.3 Schedule Status

For most of the project collecting status involving aligning status from milestone payments or subcontractor summary schedules. Below is the example of statusing the Besalco monthly status report.



ITEM	DESCRIPCIÓN	Un	CANT.	Precio Unitario (U.F.)	TOTAL (U.F.)	MES ANTERIOR	PTE. ESTADO DE PAGO	TOTAL ACUMULADO	MES ANTERIOR	PTE. ESTADO DE PAGO	TOTAL ACUMULADO	MONTO U.F.	REMANENTE %
1	OBRAS PRELIMINARES												
1.1	Instalación de faenas												
1.1.1	Construcciones e Instalaciones Provisorias	Gl	1.00	9,944.79	9,944.79	1.00	-	1.00	9,944.79	-	9,944.79	-	0.00%
1.1.2	Punto de Referencia												
1.1.3	Desmovilización del contratista												
1.2	Trazado y replanteos	m	281.00	0.58	163.54	281.00	-	281.00	163.54	-	163.54	-	0.00%
	SUB-TOTAL OBRAS PRELIMINARES				10,108.33				10,108.33		10,108.33	0.00	0.00%
2	EDIFICIO DE SERVICIOS												
2.1	OBRA GRUESA												
	SUB-TOTAL OBRA GRUESA				26,166.99				25,691.89	133.69	25,825.58	341.41	1.30%
2.1.2	ESTRUCTURAS												
2.1.2.1	Fundaciones												
2.1.2.1.1	Emplantillados	m3	23.00	5.10	117.35							117.35	100.00%
2.1.2.1.2	Cimientos	m3	265.00	7.10	1,882.03	121.68	31.68	153.31	863.79	224.99	1,088.78	793.25	42.15%
2.1.2.1.3	Sobrecimientos	m3	64.00	11.82	756.35	40.79	2.90	43.69	482.08	34.25	516.33	240.02	31.73%
2.1.2.1.4	Anclajes de fundaciones	Un	791.00	1.05	829.76	388.00	130.00	518.00	407.01	136.37	543.38	286.38	34.51%
2.1.2.1.5	Aceros de Refuerzos	Kg	27,206.00	0.05	1,227.06	16,117.07	3,431.21	19,548.28	726.92	154.76	881.68	345.38	28.15%
2.1.2.2	Pavimentos												
2.1.2.2.1	Cama de Ripio Apisonado	m2	1,255.00	0.31	389.05	248.13	178.11	426.24	76.92	55.22	132.14	256.91	66.04%
2.1.2.2.2	Radieres	m2	1,255.00	2.34	2,936.70	122.89	275.05	397.94	287.56	643.62	931.18	2,005.52	68.29%
2.1.2.3	Hormigón Armado H30												
2.1.2.3.1	Muros de Hormigón Armado	m3	494.00	6.54	3,229.28	83.70	9.06	92.76	547.16	59.24	606.40	2,622.88	81.22%
2.1.2.3.2	Pilares de Hormigón Armado	m3	198.00	6.54	1,294.33	61.93	5.11	67.04	404.81	33.42	438.23	856.10	66.14%
2.1.2.3.3	Hormigón de Losas	m3	263.00	6.54	1,719.23							1,719.23	100.00%
2.1.2.3.4	Hormigón de Vigas	m3	173.00	6.54	1,130.90	1.01	-	1.01	6.57	-	6.57	1,124.33	99.42%
2.1.2.3.5	Hormigón de Escaleras	m3	25.00	6.54	163.43							163.43	100.00%
2.1.2.3.6	Hormigón de Rampas	m3	7.00	6.54	45.76							45.76	100.00%
2.1.2.3.7	Aceros de Refuerzos	Kg	207,609.00	0.05	9,363.73	31,492.13	3,044.08	34,536.21	1,420.38	137.30	1,557.68	7,806.05	83.36%
2.1.2.3.8	Hormigón de sobrelosa (de terminación)	m2	207.00	0.58	119.85							119.85	100.00%
2.1.2.4	Moldajes												
2.1.2.4.1	Moldajes de elementos verticales, muros	m2	3,544.00	0.93	3,281.21	618.19	78.15	696.34	572.35	72.36	644.71	2,636.50	80.35%
2.1.2.4.2	Moldajes de pilares	m2	1,199.00	1.06	1,270.66	282.69	28.86	311.55	299.59	30.58	330.17	940.49	74.02%
2.1.2.4.3	Moldajes de losas vigas y dinteles	m2	2,597.00	0.94	2,451.09	256.74	25.90	282.63	242.31	24.44	266.75	2,184.34	89.12%
	SUB-TOTAL ESTRUCTURAS				32,207.77				6,337.45	1,606.55	7,944.00	24,263.77	75.34%

Figure 5.3 Basalco Status worksheet

The status report is a 1200 row report that summarizes the work Basalco has performed to date. The last column "REMANENTE %" is the amount of effort remaining for the line item. Each WBS has a summary identified in Grey. There are 53 summaries that are represented in the LSST IMS as seen below



Each line in the LSST IMS is updated with the % complete provided in the monthly invoice for status collection.

Another method of collecting status is the integration into Jira for software development activities. Currently all of Data Management 1.02C, T&S OCS, TCS, and WFS 1.04C.10, 1.04C.11, 1.04C.08, and Simulations 1.06.02.01 is integrating budget plans and status using Jira. Collecting status from Jira

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



involves exporting Epics and Stories into a status worksheet which is then imported into Primavera activity steps on activities.

The screenshot shows the Jira interface for 'Epics for PMCS'. The filter is set to 'project = DM AND issuetype = Epic AND WBS is not EMPTY'. The table lists several epics with columns for WBS, Cycle, Team, Story Points, Assignee, Description, Due, Epic Link, and Epic Name. An 'Export' menu is open over the table, showing options like 'Printable', 'Full Content', 'XML', 'RSS (issues)', 'Excel (All fields)', and 'Excel (Current fields)'.

WBS	Cycle	Team	Story Points	Assignee	Description	Due	Epic Link	Epic Name
02C.05.01	Summer 2016	Science User Interface	40	Xiuqin Wu	This epic will capture all the Java code refactoring in Firefly. It does not include the GWT to JS conversion effort.	26/Aug/16		Firefly refact...
02C.06.02.03	Summer 2018	Data Access and Database		Unassigned	Advanced performance optimizations and tuning of the shared scans. This includes: • Reschedule user queries on a different scheduler. Two possible parts to this are detecting slow queries and moving them to a slower/lower priority scan scheduler and the other would be having the czar tell the workers to move all tasks for a user query to a specific scheduler. These require unique user query ids.			FY18 Share Optim
02C.05.01	Summer 2016	Science User Interface	60	Xiuqin Wu		26/Aug/16	Beta version of LSST web UI ready	DM-4681
02C.05.02	Summer 2016	Science User Interface	40	Xiuqin Wu	We need to provide API access to all the table displaying features to give user more control when using Firefly API to build customized web UI	26/Aug/16	Provide API for tabular data display using Firefly	DM-4680
02C.05.01	Summer 2016	Science User Interface	40	Xiuqin Wu	SUI will continue to work with database team to exercise all the APIs for data access. All known issues should be worked out in S16 cycle.	26/Aug/16	SUI will continue to work with database team to exercise all the APIs for data access. All the	DM-4679

1. Log into Jira and setup the issue filter to export epics. This is done for the DM, TSS, TSSPP, and SIM projects in separate files.

The screenshot shows the Jira interface for 'Story for PMCS Resolved All'. The filter is 'project = DM AND issuetype in (Improvement, Story, Bug) AND "Epic Link" is not EMPTY AND "Story Points" is not EMPTY ORDER BY issuetype ASC'. The table lists resolved stories with columns for Key, Summary, Assignee, Status, Story Points, and Resolved. An 'Export' menu is open over the table, showing options like 'Printable', 'Full Content', 'XML', 'RSS (issues)', 'Excel (All fields)', and 'Excel (Current fields)'.

Key	Summary	Assignee	Status	Story Points	Resolved
DM-4757	LOGS usage gcc 5 incompato	Fritz Mueller	DONE	0.25	07/Jan/16
DM-4743	Make debundler more robust against weird PSF dimensions	Unassigned	TO DO	2	
DM-4705	qdisp/testQDisp fails with mariadb	Andy Sainikov	DONE	1	18/Dec/15
DM-4648	Support sqlalchemy use with qserv	Brian Van Klaveren	TO DO	3	
DM-4531	Qserv returns incorrect results for some expressions	Unassigned	TO DO	5	
DM-4529	Compilation errors from CLang (Apple LLVM 7.0) in XCode 7 on MacOSX	Mike Kelsey	DONE	1	07/Dec/15
DM-4454	Fix multiple patch catalog sorting for forcedPhotCcd.py	Lauren MacArthur	DONE	2	02/Dec/15
DM-4408	HSC backport: fix memory leak in atw:geom:polygon	Lauren MacArthur	DONE	0.5	24/Nov/15
DM-4398	Fix regexp for gcc48	Andy Sainikov	DONE	1	20/Nov/15
DM-4391	Update testCoadds.py to accommodate changes in DM-2915	Lauren MacArthur	DONE	0.5	20/Nov/15
DM-4387	Skymap fails tests on testFindTractPatch list	Paul Price	DONE	1	20/Nov/15

2. Next export the stories assigned to Epics with a filter "project in (DM, EPO, SIM, TSS, IT, SE, SUMMIT) AND (issuetype in (Epic) AND WBS is not EMPTY OR issuefunction in

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



linkedIssuesOf("issuetype in (Epic) AND WBS is not EMPTY ", "is Epic of") AND status != Duplicate))"

A	B	C	D	E	G	J	K	L	O	P	Q	R
WBS	Cycle	Team	Story Points	Epic Name	Epic Status	Key	Status	Description	Key	Activity Name	DM Cycle	Duration
02C.08.03.04				Summit to Base Payment Plan part 3	To Do	DM-2568	To Do		DM-2568	Summit to Base Paym...	0	0
02C.08.03.04	Summer 2019	International Comms and Base Site	40	Chilean Networks	To Do	DM-2563	To Do		DM-2563	Chilean Networks	Summer 2019	0
02C.06.02.01	Winter 2016	Data Access and Database	31	W16 Improvements to db	Done	DM-2513	Done	Improvements to Db wrapper.	DM-2513	W16 Improvements to d...	Winter 2016	58
02C.06.02.02	Summer 2017	Data Access and Database	53	FY17 Web Services Authentication	To Do	DM-2512	To Do	We need to integrate Data Access Web Services with Authentication mechanisms	DM-2512	FY17 Web Services Aut...	Summer 2017	0
02C.08.03.04	Summer 2015	International Comms and Base Site	40	Mountain - Base fiber path	To Do	DM-2500	To Do	Design path and installation method for Mountain - Base fiber cable. Path will run	DM-2500	Mountain - Base Fiber p...	Summer 2015	29
02C.04.01		Data Release Production		alv: table Interface Overhaul	To Do	DM-2406	To Do		DM-2406	alv: table Interface Ove...	0	0
02C.04.06		Data Release Production		Measurement Framework Enhancements	To Do	DM-2405	To Do	Longer term, lower priority improvements to the measurement framework.	DM-2405	Measurement Framework...	0	0
02C.06.02.01	Winter 2016	Data Access and Database	139	W16 Butler (v4)	To Do	DM-2404	In Progress		DM-2404	W16 Butler (v4)	Winter 2016	147
02C.06.02.03	Winter 2020	Data Access and Database	105	FY20 Fix Qserv Bugs	To Do	DM-2403	To Do	Bucket epic for unexpected bug fixes.	DM-2403	FY20 Fix Qserv Bugs	Winter 2020	0
02C.06.02.03	Summer 2019	Data Access and Database	53	FY18 Fix Qserv Bugs	To Do	DM-2402	To Do	Bucket epic for unexpected bug fixes.	DM-2402	FY18 Fix Qserv Bugs	Summer 2019	0
02C.06.02.03	Summer 2018	Data Access and Database	53	FY18 Fix Qserv Bugs	To Do	DM-2401	To Do	Bucket epic for unexpected bug fixes.	DM-2401	FY18 Fix Qserv Bugs	Summer 2018	0
02C.06.02.03	Summer 2017	Data Access and Database	53	FY17 Fix Qserv Bugs	To Do	DM-2400	To Do	Bucket epic for unexpected bug fixes.	DM-2400	FY17 Fix Qserv Bugs	Summer 2017	0
02C.06.02.03	Summer 2018	Data Access and Database	53	FY18 DR in Qserv	To Do	DM-2397	To Do	Load data challenge data into Qserv and enable analytics of the DC data through	DM-2397	FY18 DR in Qserv	Summer 2018	0
02C.06.02.03	Summer 2017	Data Access and Database	53	FY17 DC in Qserv	To Do	DM-2396	To Do	Load data challenge data into Qserv and	DM-2396	FY17 DC in Qserv	Summer 2017	0

- Copy the exported data into the EPICS and Stories template provided in the Jira Template worksheet. Columns in yellow are calculated fields and should be filled down to populate all rows with imported data.

CAM	WBS	Key	Epic Name	COMPLETE	Planned Start Date	Planned Finish	Sum of target completed story points to date	Stories Planned	Stories Complete	Sum of SP% Variance Completed / Planned 20/50
Becla J	02C.06.01.01	DM-2042	W16 Improve Data Provenance Design	In Progress	9/30/2015	2/24/2016	35	56	48	14%
	02C.06.02.01	DM-2513	W16 Improvements to db	Done	9/1/2015	10/29/2015	34	34	34	0%
	02C.06.02.02	DM-2404	W16 Butler (v4)	In Progress	9/30/2015	2/24/2016	90	144	54	63%
	02C.06.02.02	DM-3672	W16 Webserv Improvements	Done	9/1/2015	9/29/2015	10	10	10	0%
	02C.06.02.03	DM-2607	W16 Refactor Selected Elements in Q...	In Progress	11/30/2015	2/24/2016	22	61	55	10%
	02C.06.02.03	DM-2802	W16 Implement Database & Table M...	Done	9/1/2015	10/29/2015	33	33	33	0%
	02C.06.02.03	DM-3263	W16 Make Query Cancellation Robust	Done	9/1/2015	11/25/2015	59	59	59	0%
	02C.06.02.03	DM-3155	W16 Qserv Release and Testing	In Progress	9/1/2015	2/24/2016	16	23	9	61%
	02C.06.02.03	DM-2119	W16 Secondary Index	In Progress	12/1/2015	2/25/2016	17	48	17	65%
	02C.06.02.03	DM-2089	W16 Data Distribution and Replica M...	In Progress	9/1/2015	2/24/2016	78	114	89	22%
	02C.06.02.03	DM-2077	W16 Multi-table shared scans	In Progress	10/30/2015	2/24/2016	43	81	21	74%
	02C.06.02.03	DM-1708	W16 Query Coverage	In Progress	9/1/2015	2/29/2016	20	30	15	50%
	02C.06.02.03	DM-1648	W16 Technology Research	In Progress	10/30/2015	2/24/2016	16	30	5	83%
	02C.06.02.03	DM-3506	W16 Support Dynamic CSS Metadata	Done	9/1/2015	11/25/2015	32	32	32	0%
	02C.06.02.03	DM-2050	sqre-metrics-intra-capture-one	To Do	9/1/2015	9/30/2015	83	83	81	2%
	02C.06.02.03	DM-2053	stack-cl-docker	Done	10/2/2015	11/24/2015	19	19	19	0%
	02C.06.02.03	DM-3425	sqre-cl-w16	To Do	11/25/2015	12/30/2015	64	64	54	16%
	02C.06.02.03	DM-3865	sqre-verification-data-one	In Progress	10/13/2015	2/24/2016	20	35	30	13%
	02C.06.02.03	DM-3862	sqre-stack-build-two	To Do	10/13/2015	12/14/2015	8	8	7	13%
	02C.06.02.03	DM-3860	sqre-comms-two	To Do	12/29/2015	2/1/2016	0	8	8	0%
	02C.06.02.03	DM-3859	sqre-supertask	To Do	12/29/2015	2/11/2016	1	24	4	83%
	02C.06.02.03	DM-3857	sqre-doc-content-one	In Progress	11/25/2015	12/29/2015	33	33	29	12%
	02C.06.02.03	DM-3684	stack-reteag-two	To Do	12/31/2015	2/11/2016	0	23	22	4%
	02C.06.02.03	DM-1139	doc-implement-tools	In Progress	9/1/2015	11/24/2015	44	44	38	14%
	02C.06.02.03	DM-3907	FY15 Hardware Purchasing Plan	Done	9/1/2015	10/1/2015	7	7	7	0%
	02C.06.02.03	DM-3788	FY16 Hardware Purchasing Plan	In Progress	9/1/2015	10/29/2015	38	38	37	3%
	02C.06.02.03	DM-3786	Sizine model technoloov and costine	To Do	11/9/2015	1/28/2016	7	10	10	0%

- Click the Refresh all option to update the data set. Several predefined reports exist in the worksheet to report on Jira status progress.
- Next open the Status and OM Imports worksheet to import the data into Primavera

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



Objective Measures						
Activity	Activity Code	DM Name	Activity	Weight	Status	
281932	DM-1228	DM-1362 Edit pull interface and other Summer 2014 work into LSE-68 in Word		2	100	
281933	DM-1228	DM-1368 Submit LCR for LSE-68		2	100	
281934	DM-1228	DM-1389 Edit LSE-68 changes into EA		2	0	
281935	DM-1228	Remaining Stories		3	0	
281936	DM-1230	DM-1309 Edit agreed-upon changes into Word version of LSE-69		3	100	
281937	DM-1230	DM-1310 Create change request for LSE-69		1	100	
281938	DM-1230	DM-1311 Enter LSE-69 update into EA as SysML		1	100	
281939	DM-1232	DM-1312 Proofread docgened version of LSE-72		1	0	
281940	DM-1232	Remaining Stories		2	0	
281941	DM-1239	DM-1313 Identify Conditions information in LSE-130 that is required for Alert Production		2	0	
281942	DM-1239	Remaining Stories		11	0	
281943	DM-1240	DM-1241 Complete data entry of LSE-140 revised draft into EA		2	100	
281944	DM-1240	DM-1306 Pre-CCB review of LSE-140 docgen		2	100	
281945	DM-1240	Remaining Stories		4	0	
281946	DM-1377	DM-1263 completed governance of security plan for review		1	100	
281947	DM-1377	DM-1264 security plan october.		1	0	
281948	DM-1377	Remaining Stories		50	0	
281949	DM-1377	DM-1527 Draft security risks into the Center's template		4	0	
281950	DM-1120	DM-1285 Improve Startup of HTCondor Jobs		2	100	
281951	DM-1120	DM-1286 Improve worker fault tolerance of missing distributor data		6	100	
281952	DM-1120	DM-1322 Expire workers that receive no files		4	100	
281953	DM-1120	DM-1326 Automatic expiration of replicator jobs		4	100	

6. Click on the Primavera Objective Measures sheet and paste data from the Jira Template Stories sheet.

The screenshot shows a Primavera software interface. On the left, there is an 'Administration' window with the following fields: Server Name (140.252.32.47), Database (pmcs8a), DB User (privuser), and Password (*****). A 'Test Connection' button is present, and a message at the bottom of the window reads 'Connection Successful.'. On the right, there are controls for 'Primavera Project Refresh' (with a 'Refresh' button) and 'Primavera Project Select' (with a dropdown menu showing 'LSST IVE 15-12'). Below these are buttons for 'Get Objective Measures', 'Set Objective Measures', 'Get Actuals', and 'Set Actuals'. A green box highlights the 'Set Objective Measures' button.

7. Select the Administration sheet, select the project to update, and click set Objective Measures
8. In Primavera hit F5 to reload data and the Activity steps should be updated.
9. Sort Primavera activities by % Complete. Refer back to the Jira template Epics sheet and update all Actual Starts and Actual finishes manually.

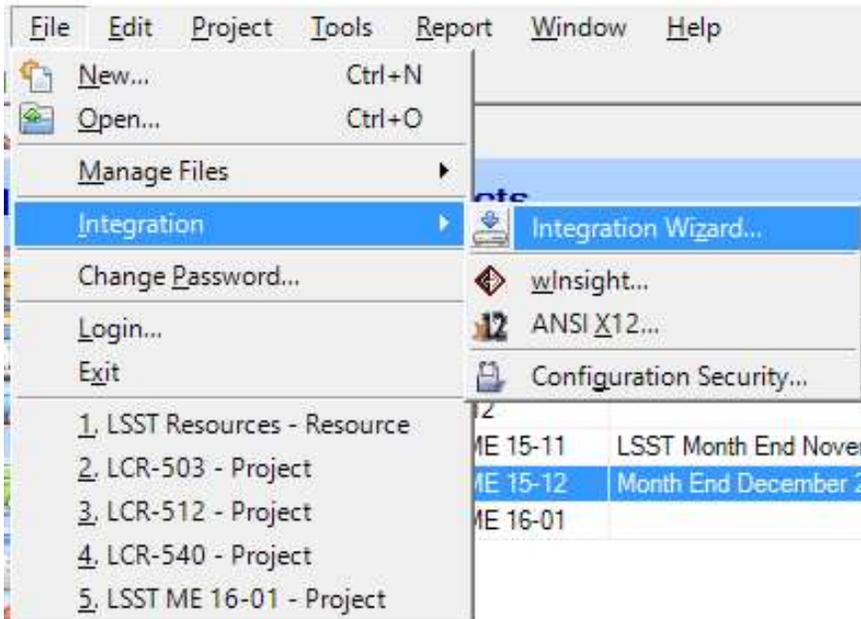
The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.

10. If an Epic is in progress evaluate if Remaining Stories are needed. This is the delta between the original story estimate and the currently planned stories on the epic.

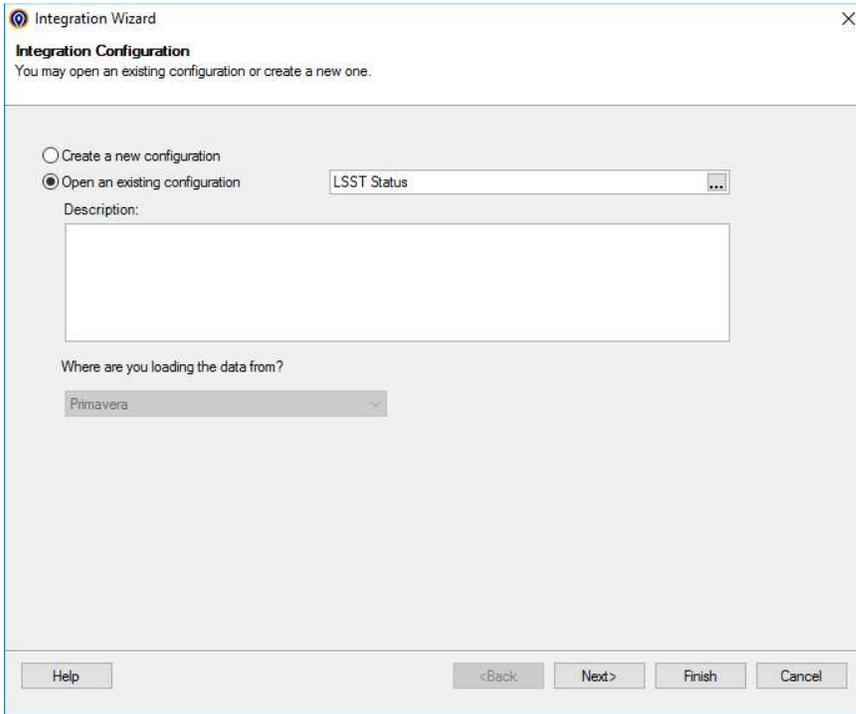
Once all status has been collected the data is ready to be integrated into cobra. This is done by running the following process steps in Cobra.



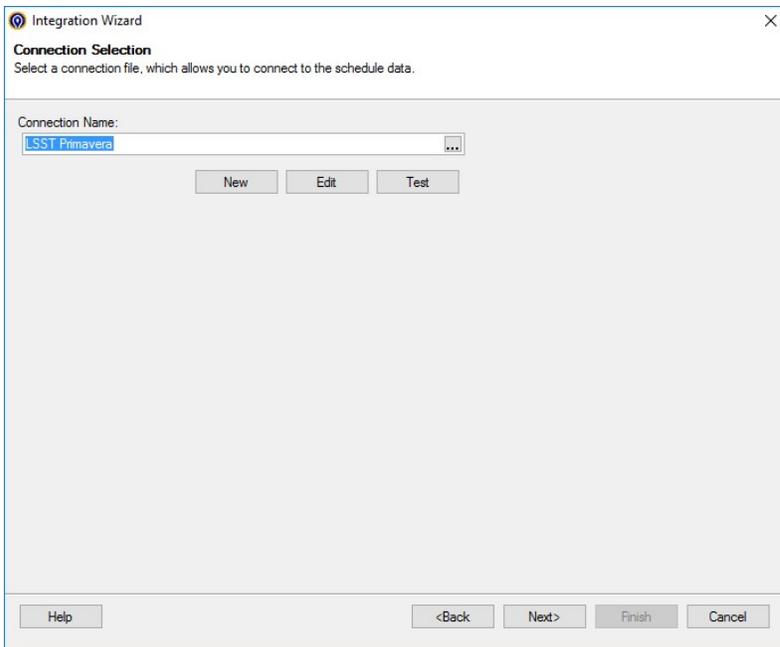
1. Advance the Cobra calendar to the next period



2. Run the Integration Wizard



3. Select the predefined template LSST Status



4. Select the "LSST Primavera" Connection which is an ODBC datasource pointing to the Primavera Database

Integration Wizard

Action Selection
Which actions do you want the Integration Wizard to perform?

Ancillary Data
 Codes
 Resources and Rates

Project Data
 Control Account and Work Package
 Code Assignments
 Resource Assignments
 Status
 Notes

Use this page to select the actions you want to perform. Options on subsequent pages will be based on the actions selected.

At least one action must be selected in order to continue.

Help <Back Next> Finish Cancel

5. Select Status

Integration Wizard

Project Selection
Select your Cobra project and the schedule you are integrating with.

Schedule Project:
LSST ME 15-12

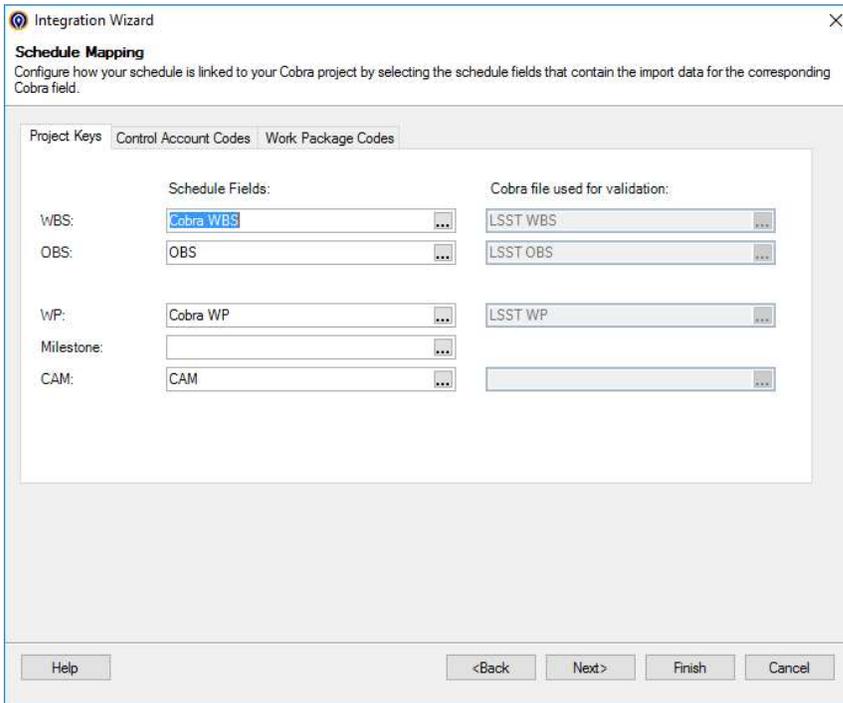
Cobra Project:
LSST ME 15-12

Create a new project

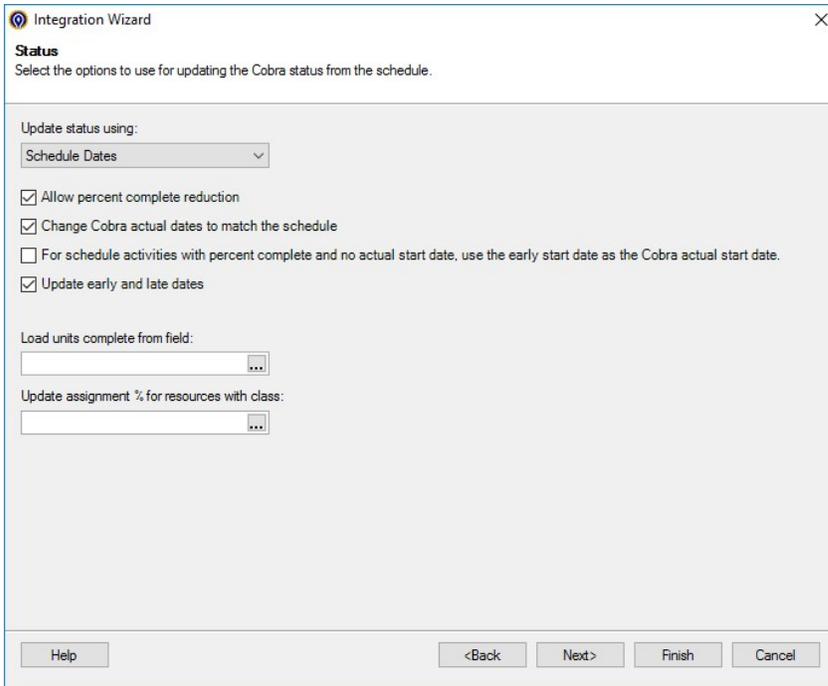
Synchronization Options
 Populate only the link table

Help <Back Next> Finish Cancel

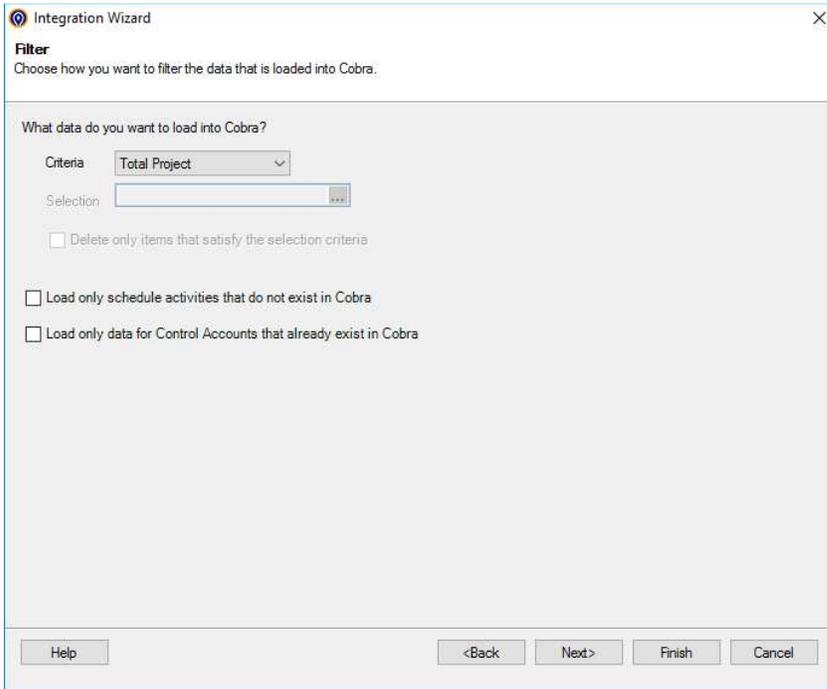
6. Select the source Primavera project and the destination cobra project



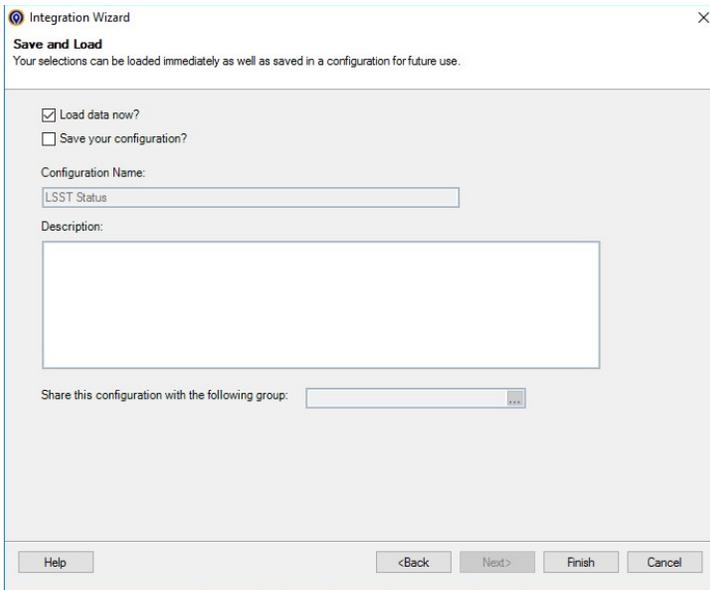
7. Ensure the mapping between Cobra and Primavera data fields matches as listed above



8. The Selections ensure Cobra data always accurately matches Primavera data



9. Always integrate the total project for a complete status load



10. Click finish to integrate status into Cobra

There is a many to one relationship between activities in the IMS and a work package in Cobra. The EV for a Work package is calculated in Cobra by determining the earned amount for each activity in relation to its budget and % complete. The sample data below shows the flow from Primavera budget and status



to the integration in Cobra

WBS	Activity ID	Activity Name	Physical % Complete	Budgeted Total Cost	\$ Earned (% comp * Total cost)
LSST.02C.04.01	DM-1074	Measurement - Calibration and Ingest	100%	\$9,380.95	\$9,380.95
LSST.02C.04.01	DM-1099	afw::table - finish interface transition	100%	\$16,617.07	\$16,617.07
LSST.02C.04.01	DM-1100	Measurement - Convert Old Algorithms	100%	\$31,951.49	\$31,951.49
LSST.02C.04.01	DM-1101	Measurement - Finish Framework Overhaul	100%	\$23,877.55	\$23,877.55
LSST.02C.04.01	DM-1107	afw - Footprint Improvements	100%	\$44,799.08	\$44,799.08
LSST.02C.04.01	DM-1109	Measurement - MultiFit Plugin Framework	0%	\$15,066.95	\$0.00
LSST.02C.04.01	DM-1904	Continued footprint improvements	12.50%	\$83,507.50	\$10,438.44
LSST.02C.04.01	DMTC-2300-0190	Application Framework DRP Scope Planning R5.1	100%	\$1,410.40	\$1,410.40
Total				\$226,610.99	\$138,474.98
				% Complete for WP	61.11%
				\$ Earned / Total Cost	61.11%

Figure 5.3a Primavera Status

WBS	WP	Description	Budget	Earned	Actuals	BAC
1.02C.03.08		Astrometric Calibration Pipeline	\$70,866.02	\$0.00	\$57,622.42	\$98,097.48
1.02C.04.00		Data Release Management Engineering and I	\$296,619.78	\$263,427.14	\$225,404.91	\$1,953,129.00
1.02C.04.01		Application Framework for Catalogs	\$226,610.72	\$138,481.81	\$91,511.39	\$3,303,486.67
1.02C.04.01	KLM20401A.PP	Application Framework for Catalogs Planning	\$0.00	\$0.00	\$0.00	\$3,076,875.95
1.02C.04.01	KLM20401A.PROC	Application Framework for Catalogs Professional Services	\$226,610.72	\$138,481.81	\$91,511.39	\$226,610.72
1.02C.04.02		Calibration Products Production	\$0.00	\$0.00	\$0.00	\$2,527,544.60
1.02C.04.03		PSF Estimation	\$1,410.39	\$1,409.08	\$0.00	\$3,172,316.17
1.02C.04.04		Image Coaddition Pipeline	\$0.00	\$0.00	\$0.00	\$1,068,861.04
1.02C.04.05		Deep Detection Pipeline	\$0.00	\$0.00	\$0.00	\$183,413.37
1.02C.04.06		Object Characterization Pipeline	\$286,920.94	\$115,695.03	\$223,152.76	\$3,195,573.77

General | Resource Assignments | Milestones/Steps | Notes

Status: In-progress
 Description: Application Framework for Catalogs Professional Services
 Work Package Manager: [...]
 Dates:
 Baseline: Start: 10/01/2014, Finish: 05/29/2015
 Actual: Start: 10/01/2014, Finish: [...]
 Forecast: Start: 10/01/2014, Finish: 09/28/2015
 Early: Start: 10/01/2014, Finish: 09/28/2015
 Earned Value Technique:
 EVT: % Complete
 % Completed: 61.11

Figure 5.3b Cobra Summary of Work Package and Earned Value

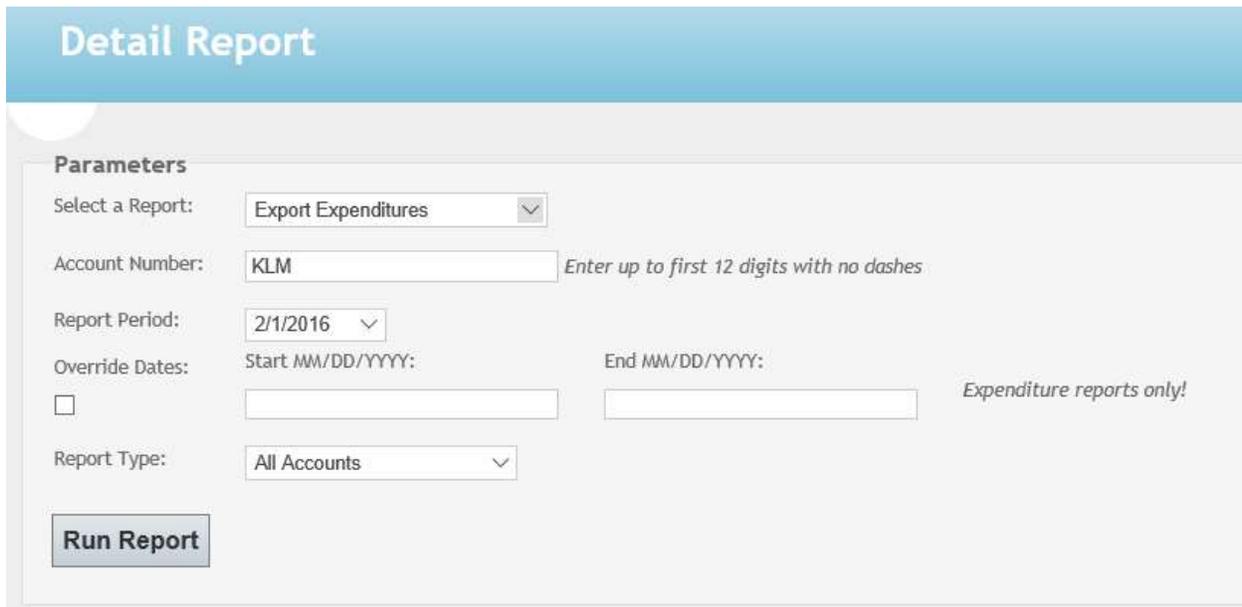
5.4 Actual Costs

The cumulative to date actual costs for the LSST project are imported into Cobra each month. This is done once CAS has closed the accounting period to insure that Cobra in sync monthly with costs recorded in CAS, the system of record for LSST cost accounting.

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.

The CASNet web based reporting system is used to pull actuals for the project once Accounting has closed the previous period.

The export file produced from CASNet is loaded into the Actuals Processor to create the import file for Cobra. This template formats the CAS charge number into the LSST work package format and breaks out the charges by resource code. Since there is a one to one map between CAS cost elements and Cobra actual resources there is no loss of fidelity between the two systems. After the actual costs are imported into Cobra, the total ACWP is compared to the total actual cost in CAS to insure that all costs imported correctly.



Detail Report

Parameters

Select a Report: Export Expenditures

Account Number: KLM *Enter up to first 12 digits with no dashes*

Report Period: 2/1/2016

Override Dates: Start MM/DD/YYYY: End MM/DD/YYYY: *Expenditure reports only!*

Report Type: All Accounts

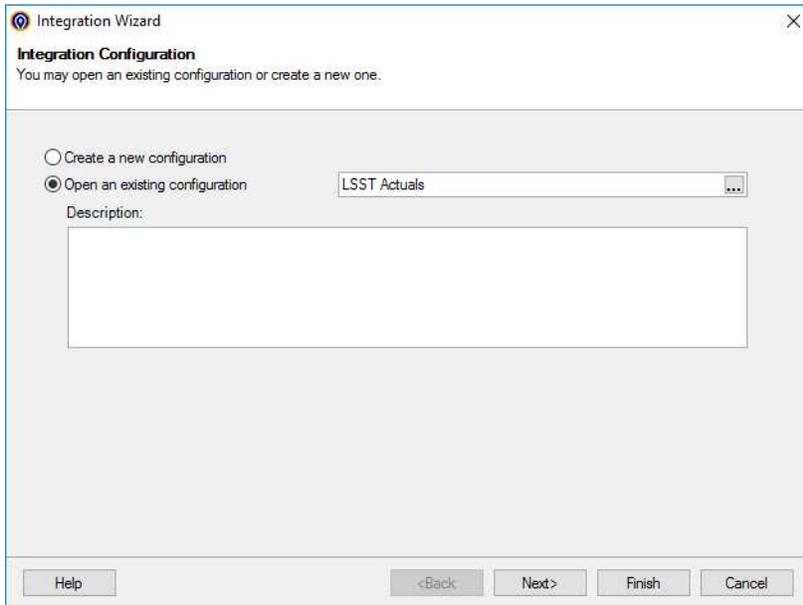
Run Report

Figure 4 CAS Export Option

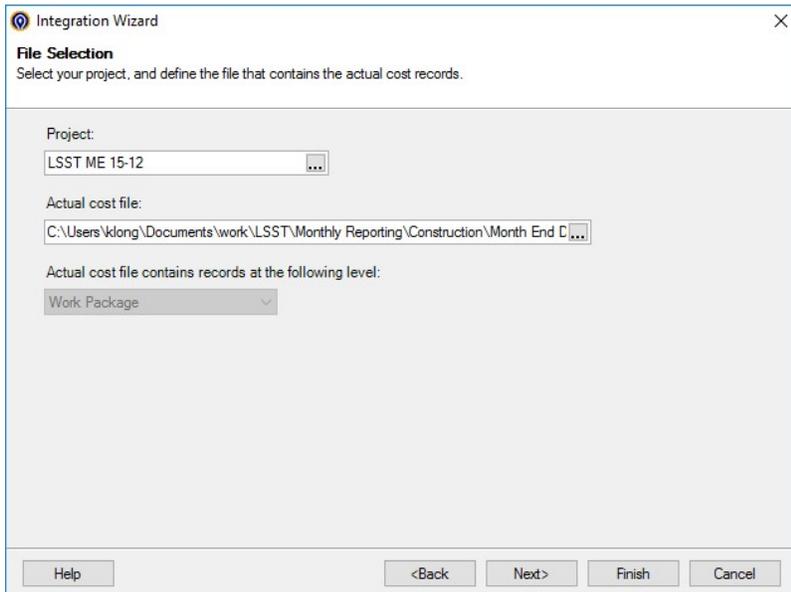
Loading Actuals into Cobra is performed by executing the following steps



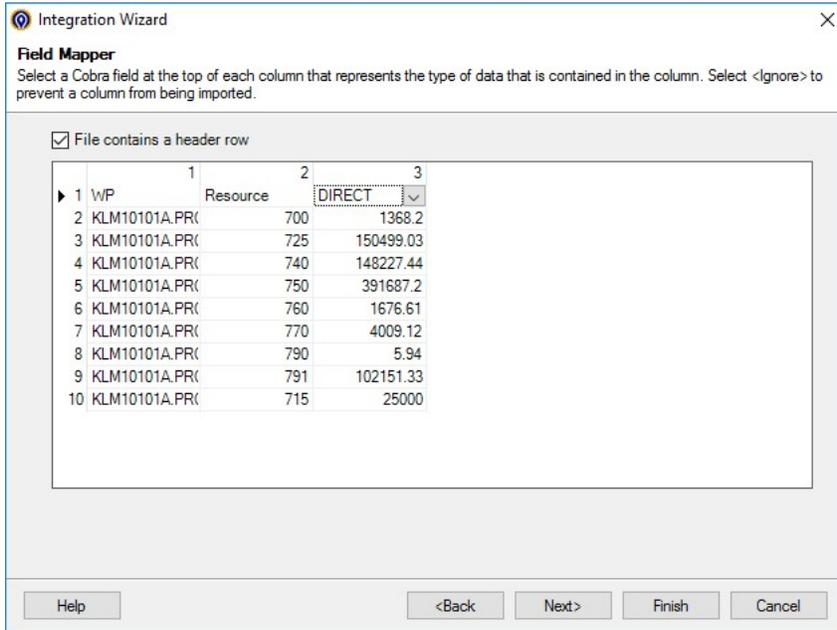
1. Select Actual costs from the Integration Wizard and click next



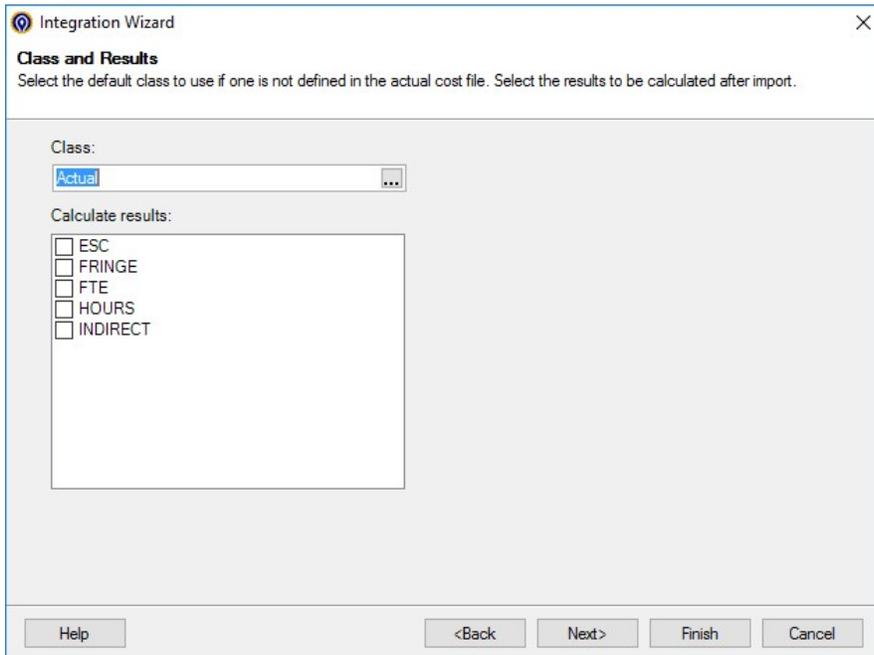
2. Load the predefined LSST Actuals template and click next



3. Select the current LSST project and browse to the import file created by running the actuals processor



4. Ensure proper column mapping and click next



5. The default class should be Actuals and no other calculations are performed, click next

Integration Wizard

Included Costs
Does the actual cost file contain cumulative or period costs?

Period Costs

- Replace existing
 - Post valid records
 - Prevent loading historical actual costs.

Cumulative Costs

- Zero unreferenced actual costs
- Select classes to exclude:
Estimated Actuals
- Exclusion file:

Help <Back Next> Finish Cancel

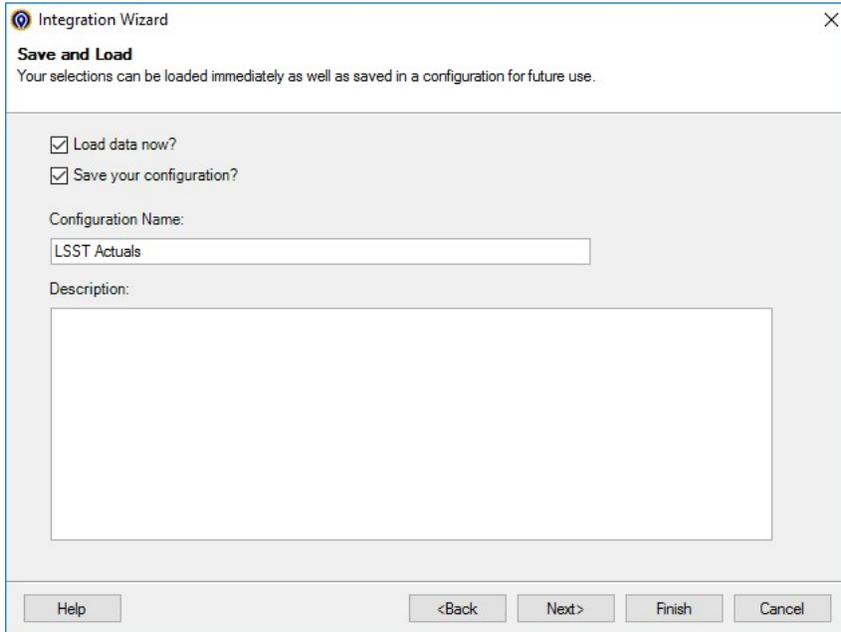
Integration Wizard

Options
Select the options to apply to the process.

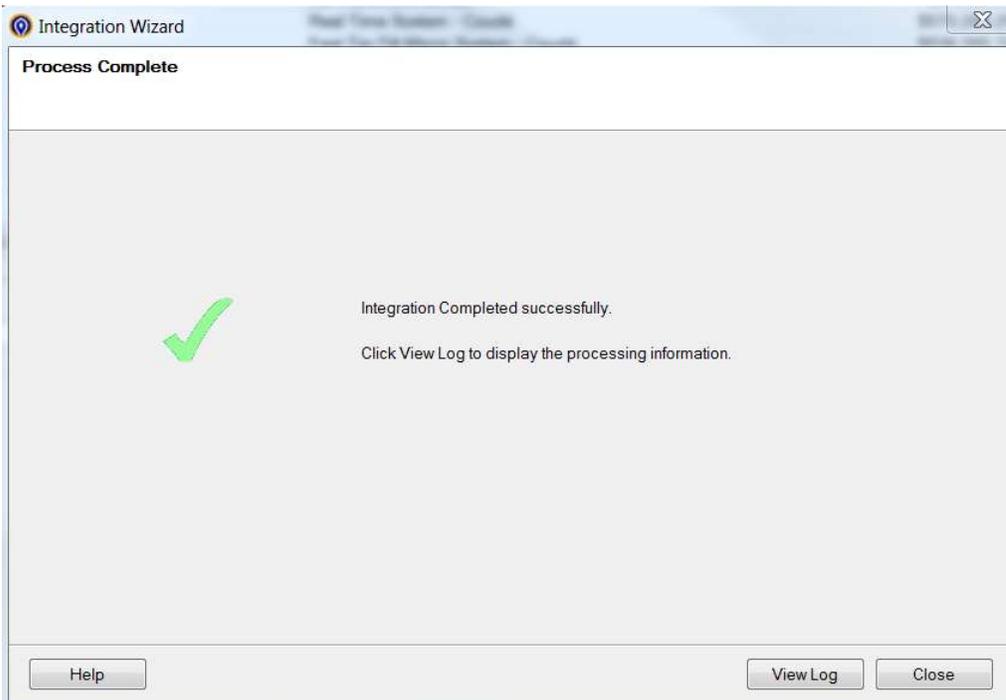
- Print the values of the invalid records to the process log.
- Generate a separate process log for each sub project.
- Allow posting actual costs to a planned Control Account or Work Package.
 - Use the status date as the actual start date when posting values.
- Allow posting actual costs to a completed Control Account or Work Package.

Help <Back Next> Finish Cancel

- To ensure actuals in Cobra match actuals from CAS we import cumulative to date actuals and post all valid entries.



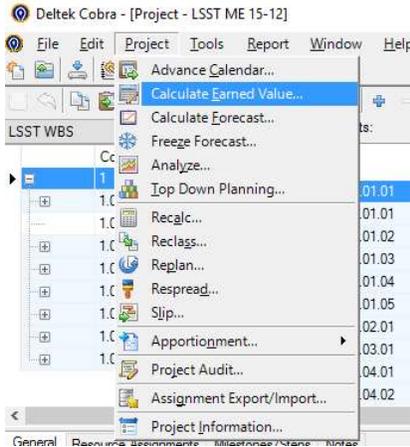
7. Load the data and save the configuration in case it needs to be run again.



8. Once the actuals have been successfully imported. Run a report to confirm that the total actuals for the month matches the total sum in the import file.

5.5 Calculate Earned Value [Guideline 22]

Once the schedule status for milestones and the actuals have been imported, the Calculate Earned Value function can be performed.



Calculating the earned value will run the necessary calculations at the Work Package and Control Account levels to show Cost and Schedule variances. This information is available in eCAM as current period and cumulative to date.

5.6 Variance Analysis [Guideline 23]

Analysis of performance measurement data identifies and documents the aspects of cost, schedule, and work scope that may require management attention, assesses the impact of these conditions on the baseline and future work, and develops and implements corrective actions.

Variances are calculated at the Work Package level and rolled up to the control account level based on the monthly status and actuals. Variance analysis is performed and reported by the responsible CAM for any cumulative schedule or cost variance that exceeds the thresholds defined in the table below.

Variance Thresholds		
Cumulative CV or SV	>= 75k < \$100k	>= \$100k
Cumulative CPI or SPI	>= 5% < 10%	>= 10%

Figure 5.6: Variance Thresholds

The EV metrics used include both cost and schedule variances and performance indices. Performance indices include the Cost Performance Index (CPI=EV/AC) and the Schedule Performance Index (SPI=EV/PV). Graphics are used to aid in displaying trends associated with project performance. The CAM will assess these indices to look for control account performance trends.

Variance analyses and other outputs of the EVMS are used by the project management team (including CAMs) to formulate corrective actions. All cost and schedule variances that exceed the thresholds defined as “red” in Table 5.6 will require the generation of a Variance Analysis Report (VAR) by the CAM. The CAMs



are responsible for determining the cause of the variance and its impact on the control account and the related activities and milestones, developing a corrective action that will be managed and eventually closed.

5.7 Indirect cost variance analysis [Guideline 2.4c]

The Overhead rate is fixed for all sub awards for the life of the project, so analysis of the overhead rate is not necessary as it will not change.

5.8 Reporting [Guideline 25, 26]

The reports generated from the PMCS are available in a web application known as eCAM, or electronic CAM Notebook. An orderly process is used to collect, review, report, and use the data generated by the system. The monthly reporting cycle is based on the accounting month which ends on the last day of each calendar month. These project status reports contain the following information:

- Budget summary
- CPI/SPI Trending
- Status of key milestones
- Progress narrative
- Baseline change control log
- EVMS data
- Variance explanations (when required)

Electronic systems have been developed at LSST to serve this reporting data directly from the Cobra and Primavera databases in a system that allows drilling from a high WBS level all the way to the activity and activity step level to facilitate simplified analysis and reporting.

Project [LSST ME 15-06] CAM [Swinbank J] WBS Level [All] WBS [1 - LSST May 2015 Month End Baseli] Only Show Variances Hide WBS Summary Hide Completed Expand All

Near Term Responsibilities Procurement Milestone

WBS / WP	Current Period								Cumulative to Date								At Complete	
	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	BAC	EAC	% Spant Complete	% Complete
1	\$70,168	\$35,688	\$123,809	(\$34,479)	(\$88,121)	0.51	0.29	\$782,330	\$511,436	\$503,884	(\$270,894)	\$7,552	0.65	1.01	\$15,362,042	\$15,263,820	3%	3%
1.02C	\$70,168	\$35,688	\$123,809	(\$34,479)	(\$88,121)	0.51	0.29	\$782,330	\$511,436	\$503,884	(\$270,894)	\$7,552	0.65	1.01	\$15,362,042	\$15,263,820	3%	3%
1.02C.04	\$70,168	\$35,688	\$123,809	(\$34,479)	(\$88,121)	0.51	0.29	\$782,330	\$511,436	\$503,884	(\$270,894)	\$7,552	0.65	1.01	\$15,362,042	\$15,263,820	3%	3%
1.02C.04.00	\$50,855	\$21,028	\$47,306	(\$29,827)	(\$26,278)	0.41	0.44	\$296,620	\$263,427	\$225,405	(\$33,193)	\$38,022	0.89	1.17	\$1,953,129	\$1,873,603	12%	13%
1.02C.04.01	\$0	\$0	\$22,682	\$0	(\$22,682)	0.00	0.00	\$226,611	\$138,482	\$91,511	(\$88,129)	\$46,970	0.61	1.51	\$3,303,487	\$3,243,856	3%	4%
KLM20401A.PP	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$3,076,876	\$3,076,876	0%	0%
KLM20401A.PROC	\$0	\$0	\$22,682	\$0	(\$22,682)	0.00	0.00	\$226,611	\$138,482	\$91,511	(\$88,129)	\$46,970	0.61	1.51	\$226,611	\$166,980	40%	61%
1.02C.04.02	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$2,527,545	\$2,527,545	0%	0%
1.02C.04.03	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$1,410	\$1,409	\$0	(\$1)	\$1,409	1.00	0.00	\$3,172,316	\$3,170,907	0%	0%
1.02C.04.04	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$1,068,861	\$1,068,861	0%	0%
1.02C.04.05	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$183,413	\$183,413	0%	0%
1.02C.04.06	\$19,313	\$14,660	\$53,821	(\$4,653)	(\$39,161)	0.76	0.27	\$257,690	\$108,118	\$186,967	(\$149,572)	(\$78,849)	0.42	0.58	\$3,153,291	\$3,195,635	6%	3%

ID	Resource Description	Baseline Start	Baseline Finish	Forecast/Actual Start	Forecast/Actual Finish	% Comp.	Total Float	Planned Cost	Planned Hours	Target Duration	Remaining Duration
LSSE-PRINCETON - Sr. Software Engineer-PRINCETON	DM Sr. Software Engineer	11-Dec-14	29-Dec-14	20-Jan-15 A	31-Jan-15 A	100.0	0	\$44,799	166	11	0
DM-1107 - afw - Footprint Improvements	DM Sr. Scientist						0	0			0
LSC-PRINCETON - Scientist-PRINCETON	DM Sr. Scientist						0	0			0
LSC-PRINCETON - Scientist-PRINCETON	DM Sr. Scientist						0	0			0
LSSE-PRINCETON - Sr. Software Engineer-PRINCETON	DM Sr. Software Engineer	30-Dec-14	16-Feb-15	01-Jul-15	14-Aug-15	0.0	-19	\$15,067	126	33	33
DM-1109 - Measurement - MultiFit Plugin Framework	DM Software Engineer						0	0			0
LSEN-UCD - Software Engineer - UCD	DM Sr. Software Engineer						-19	\$83,508	296	64	63
LSSE-PRINCETON - Sr. Software Engineer-PRINCETON	DM Sr. Software Engineer	02-Mar-15	29-May-15	02-Mar-15 A	28-Sep-15	12.5	-19	0			0
DM-1304 - Continued footprint improvements	DM Scientist						0	0			0
LSC-PRINCETON - Scientist-PRINCETON	DM Sr. Scientist						0	0			0
LSC-PRINCETON - Scientist-PRINCETON	DM Sr. Scientist						0	0			0
DMTC-2300-0190 - Application Framework DRP Scope		30-Jan-15	26-Feb-15	02-Feb-15 A	27-Feb-15 A	100.0		\$1,410	5	20	20
Total:								\$2,048	138,474		

eCAM facilitates this by showing all current period, cumulative, and at complete EVMS data for all WBS/CA/WPs for the entire project.

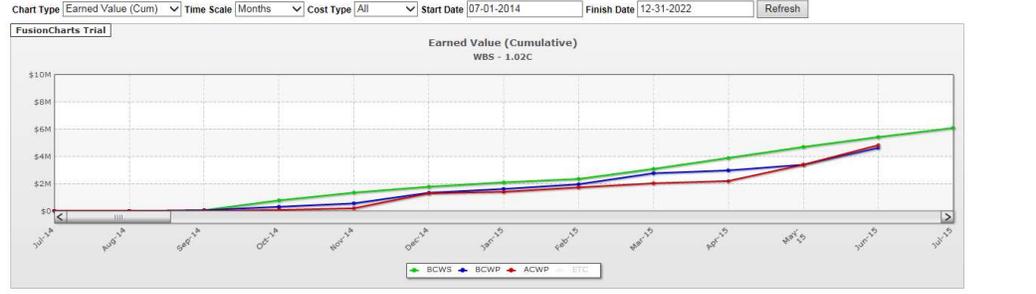
The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



WBS / WP	Current Period				Cumulative to Date								At Complete					
	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	BAC	EAC	% Spent	% Complete
1.02C	\$739,924	\$1,243,123	\$1,433,530	\$505,199 (\$190,387)	1.68	0.87	\$5480.515	\$4,825,024	\$4,842,382	(\$835,491)	(\$217,358)	0.85	0.96	\$129,762,001	\$129,046,442	43%	43%	
1.02C.01	\$111,037	\$184,959	\$150,333	\$73,522	\$34,625	1.67	1.23	\$858,053	\$844,155	\$975,825	(\$13,898)	(\$131,670)	0.98	0.87	\$10,947,619	\$10,856,391	9%	8%
1.02C.01.01	\$56,137	\$177,409	\$123,852	\$121,273	\$53,557	3.16	1.43	\$516,460	\$745,968	\$741,571	\$229,508	\$4,397	1.44	1.01	\$5,196,956	\$4,960,763	14%	14%
1.02C.01.02	\$54,900	\$7,549	\$26,481	(\$47,351)	(\$18,932)	0.14	0.29	\$341,593	\$98,188	\$234,255	(\$243,406)	(\$136,067)	0.29	0.42	\$5,750,663	\$5,895,628	4%	2%
1.02C.02	\$68,682	\$47,640	\$14,107	(\$21,042)	\$33,533	0.69	3.38	\$468,091	\$381,645	\$136,697	(\$86,446)	\$244,949	0.82	2.79	\$4,266,157	\$4,026,104	3%	9%
1.02C.02.01	\$9,981	\$9,981	\$0	\$0	\$9,981	1.00	0.00	\$102,727	\$102,727	\$5,340	\$0	\$97,387	1.00	19.24	\$922,078	\$824,691	1%	11%
1.02C.02.02	\$58,701	\$37,659	\$14,107	(\$21,042)	\$23,552	0.64	2.67	\$965,365	\$278,919	\$131,357	(\$86,446)	\$147,562	0.76	2.12	\$3,344,079	\$3,201,413	4%	8%
1.02C.03	\$44,434	\$13,521	\$35,086	(\$30,913)	(\$21,565)	0.30	0.39	\$339,445	\$151,181	\$262,466	(\$188,264)	(\$111,285)	0.45	0.58	\$9,536,084	\$9,647,414	3%	2%
1.02C.03.00	\$12,274	\$11,552	\$15,721	(\$722)	(\$4,169)	0.94	0.73	\$64,192	\$60,027	\$131,347	(\$4,165)	(\$71,320)	0.94	0.46	\$1,072,860	\$1,143,348	12%	6%
1.02C.03.01	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$31,882	\$31,882	\$10,548	\$0	\$21,334	1.00	3.02	\$3,521,100	\$3,499,767	0%	1%
1.02C.03.02	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$143,400	\$143,400	0%	0%
1.02C.03.03	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$128,459	\$128,459	0%	0%
1.02C.03.04	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$11,451	\$0	\$4,372	(\$11,451)	(\$4,372)	0.00	0.00	\$2,903,410	\$2,907,782	0%	0%
1.02C.03.05	\$32,160	\$1,969	\$7,880	(\$30,191)	(\$5,911)	0.06	0.25	\$161,054	\$59,272	\$58,577	(\$101,782)	\$695	0.37	1.01	\$966,608	\$966,788	6%	6%
1.02C.03.06	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$506,453	\$506,453	0%	0%
1.02C.03.07	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$0	\$0	\$0	\$0	\$0	0.00	0.00	\$195,697	\$195,697	0%	0%
1.02C.03.08	\$0	\$0	\$11,485	(\$11,485)	\$0	0.00	0.00	\$70,866	\$0	\$57,622	(\$70,866)	(\$57,622)	0.00	0.00	\$88,097	\$155,720	0%	0%

Schedule Activities and Objective Measures: Activities Requiring Objective Measures

Variance Narrative: Schedule Variance, Cost Variance, Selected WBS



Status indicators exist in eCAM to not only highlight costs that have tripped variance thresholds, but also date indicator lights to highlight the following situations;

- Red: Today's date >= forecast start/finish date and Today's date >= BL start/finish date
- Yellow: Forecast start/finish date > BL start /finish date and today's date < BL Start/ BL Finish
- Green: Forecast start/finish date <= BL start /finish date and today's date < BL Start/ BL Finish

Milestones within	WBS	Activity ID	Description	Start/Finish	BL Start/Finish	MS Level	Lev
2 Months	1.02C.07.04	DLP-449	Upgrade storage server hardware	04-Jan-2016	02-Feb-2015	3.00	
	1.02C.07.02	DLP-414	Evaluate infrastructure of file systems based on astronomical softwa...	04-Jan-2016	31-Aug-2015	3.00	
	1.02C.07.02	DLP-404	Identify candidate security packages	04-Jan-2016	31-Aug-2015	3.00	
	1.02C.07.02	DLP-411	Monitor OpenStack	04-Jan-2016	05-Feb-2016	3.00	

eCAM will highlight all control accounts and work packages that have tripped the variance reporting threshold. CAMs are directed to populate an Explanation and corrective action at the control account at a minimum. It is encouraged that this data is captured at the work package level and aggregated to the parent control account. Past narratives are evaluated each month to address issues that aren't being resolved.

The contents of this document are subject to configuration control and may not be changed, altered, or their provisions waived without prior approval.



WBS / WP	Current Period				EVT:				Cumulative to Date				At Complete			
	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	Budget BCWS	Earned BCWP	Actuals ACWP	SV	CV	SPI	CPI	BAC	EAC
1.01C.01.03	\$31,849	\$31,846	\$17,942	(\$3)	\$13,904	1.00	1.77	\$490,047	\$490,059	\$271,220	\$12	\$218,839	1.00	1.81	\$2,232,581	\$2,013,742
1.01C.01.04	\$23,422	\$23,474	\$29,275	\$52	(\$5,801)	1.00	0.80	\$352,904	\$352,880	\$333,933	(\$24)	\$18,948	1.00	1.06	\$1,960,443	\$1,941,495
1.01C.01.05	\$26,750	\$37,378	\$1,285	\$10,628	\$36,093	1.40	29.09	\$440,346	\$459,056	\$371,384	\$18,710	\$87,672	1.04	1.24	\$1,671,575	\$1,583,902
1.01C.02	\$82,498	\$82,644	\$78,270	\$146	\$4,375	1.00	1.06	\$869,366	\$869,501	\$673,368	\$136	\$196,133	1.00	1.29	\$4,446,667	\$4,250,533
1.01C.02.01	\$82,498	\$82,644	\$78,270	\$146	\$4,375	1.00	1.06	\$869,366	\$869,501	\$673,368	\$136	\$196,133	1.00	1.29	\$4,446,667	\$4,250,533
1.01C.03	\$29,257	\$29,230	\$22,161	(\$28)	\$7,069	1.00	1.32	\$471,104	\$471,119	\$244,982	\$15	\$226,137	1.00	1.92	\$2,737,740	\$2,511,604
1.01C.03.01	\$29,257	\$29,230	\$22,161	(\$28)	\$7,069	1.00	1.32	\$471,104	\$471,119	\$244,982	\$15	\$226,137	1.00	1.92	\$2,737,740	\$2,511,604
1.01C.04	\$48,503	\$36,862	\$71,034	(\$11,641)	(\$34,172)	0.76	0.52	\$1,450,563	\$1,321,816	\$1,077,168	(\$128,747)	\$244,648	0.91	1.23	\$4,118,703	\$3,874,054
1.01C.04.01	\$36,658	\$36,862	\$34,925	\$204	\$1,937	1.01	1.06	\$846,057	\$846,212	\$775,829	\$155	\$70,383	1.00	1.09	\$3,478,662	\$3,408,279
1.01C.04.02	\$11,845	\$0	\$36,109	(\$11,845)	(\$36,109)	0.00	0.00	\$604,507	\$475,604	\$301,339	(\$128,902)	\$174,265	0.79	1.58	\$640,041	\$465,775
1.01C.05	\$155,104	\$155,214	\$71,838	\$110	\$83,377	1.00	2.16	\$2,061,871	\$2,061,778	\$1,227,410	(\$93)	\$834,368	1.00	1.68	\$8,300,233	\$7,465,866
1.01C.05.01	\$155,104	\$155,214	\$71,838	\$110	\$83,377	1.00	2.16	\$2,061,871	\$2,061,778	\$1,227,410	(\$93)	\$834,368	1.00	1.68	\$8,300,233	\$7,465,866
1.02C	\$1,131,460	\$668,379	\$1,203,283	(\$463,081)	(\$534,904)	0.59	0.56	\$13,537,911	\$11,384,800	\$10,962,243	(\$2,153,111)	\$422,556	0.84	1.04	\$130,078,938	\$129,656,382
1.02C.01	\$200,390	\$141,186	\$11,745	(\$59,204)	\$129,441	0.70	12.02	\$1,599,512	\$1,418,460	\$1,405,548	(\$181,052)	\$12,912	0.89	1.01	\$11,179,920	\$11,167,008
1.02C.01.01	\$54,627	\$54,495	(\$42,797)	(\$133)	\$97,292	1.00	-1.27	\$841,256	\$841,306	\$830,514	\$50	\$10,792	1.00	1.01	\$5,321,926	\$5,311,134
1.02C.01.02	\$145,763	\$86,692	\$54,543	(\$59,071)	\$32,149	0.59	1.59	\$758,256	\$577,154	\$575,033	(\$181,102)	\$2,120	0.76	1.00	\$5,857,995	\$5,855,874
1.02C.02	\$56,837	\$55,874	\$120,759	(\$963)	(\$64,885)	0.98	0.46	\$941,565	\$841,706	\$649,451	(\$99,850)	\$192,755	0.89	1.30	\$4,270,738	\$4,078,483

Schedule Activities and Objective Measures

Activities Requiring Objective Measures

Variance Narrative Schedule Variance Cost Variance Selected Control Account: 1.01C.04.02

Narrative Period: 12/31/2015 Narrative Category: Explanation Copy Prior Month Narratives Aggregate Narratives

Submit

Explanation This schedule variance of 129K is driven by the late recruitment of the following positions: the EPO Project Manager (EP01) and two of the EPO staff (EPO2 and EPO3), the Telescope Data Analyst (TS23), and the Remote Observing System Developer (TS19). The positive cost variance is caused by the favorable cost of the hires that have been made, getting more from internal AURA transfers, local hires, and otherwise in-expensive moving costs for the new staff members.

Corrective Action We are expecting to have the EPO Manager onboard early in 2016. The TS19 requisition has been placed and is in progress. Hiring for the other EPO positions will start early-to-mid 2016, and the scope for the Telescope Data Analyst position is being evaluated prior to opening a new position requisition.

5.9 Revise EAC [Guideline 27]

LSST has implemented a new formal procedure to capture a bottom up ETC on a real time basis from the CAMs. The previous ETC process would be run at least on an annual basis. As we get closer to project completion and limited remaining contingency, a reliable ETC becomes more important to predict if we will be able to complete the project within available cost and schedule. The ETC is the amount of money required to complete the remaining work from the period status date. The Estimate at Complete (EAC) is the sum of actuals to date and the ETC. CAMs have been trained to always ask themselves if they have adequate remaining budget (and schedule) to complete their scope of work. If the answer is no, the CAMs will submit a formal ETC request.

The new process to request ETC is very similar to a request of contingency, but there are some subtle differences. The workflow states to request a modification to the baseline ETC is defined below;

- 1) Proposed - Originator submits
- 2) LCR Assigned – The Documentation specialist assigns an LCR# and advance to Project controls for analysis. Once Project Controls has determined the cost and schedule impact the ETC LCR will be advanced for subsystem manager approval.
- 3) Approval Pending ETC – Approval by the subsystem manager.
- 4) Approval Pending - Approval by the Project Manager.
- 5) Fully Implemented - Project Controls will implement changes in the baseline schedule. A code field "Cost Class" is used to distinguish ETC and the BAC.



Definition on when a request for contingency vs ETC generally follows the guidelines below.

- 1) If a CAM is 100% sure of the amount of the request and it is needed in the next 6 months or earlier a request for contingency should be requested instead of adding to the ETC.
- 2) If the budget is needed later than 6 months and there is still some uncertainty in the details, the CAM should request it is added to the ETC. As the project gets closer to the needed date of the ETC request a subsequent LCR will be processed to move the budget from the ETC to the BAC. Because the ETC details are already in the plan the LCR process will be streamlined and processing the LCR should be a simple as changing the cost class from "Manual ETC" to "Budget". Because of this process the project expects to see most of the contingency requests originate from previously submitted ETC requests.

The ETC is integrated into Cobra using the integration wizard much like pulling budget from Primavera into Cobra. Forecast data pulls the "Budget" Cost set for remaining budgeted work and the "Manual ETC" cost set for overrides to the baseline remaining data.

6 Revisions and Data Maintenance

6.1 Change Control [Guideline 28, 29, 30, 31]

Change control ensures that project changes are identified, evaluated, coordinated, controlled, reviewed, approved and documented in a manner that best serves the project. Changes to the PMB are authorized through the change control process documented in the Change Control Process (LPM-19). Each candidate change is documented in a LSST Change Request (LCR) which defines the impact and justification of the change and provides the basis for the change. A Change Control Board advises the Project Manager on the disposition of each LCR (adoption, rejection, etc.). The magnitude of the change determines the approval requirements as defined in the procedure.

The changes that trigger a formal LCR and CCB process include changes to the PMB resulting from modifying work plans, rolling wave planning (i.e., converting planning packages to work packages), refinement of preliminary estimates and/or plans, and externally driven changes. Other examples include:

- Scope, schedule, and budget transfers between control accounts
- Changes to the work approach that change the control account scope or the BAC
- Future rate changes significant enough to warrant update
- Funding revisions that affect resource availability
- Adjusting contract budget values to reflect negotiated values
- Adjusting material budgets to reflect modifications after design phases
- Change in make/buy plans

Funds may be moved from contingency to a control account via a single LCR.

Retroactive changes to actual costs and planned or earned value are only made to correct errors, implement routine accounting adjustments (such as annual labor rate adjustments), improve the baseline integrity and accuracy of performance measurement data, or in response to approved external direction.



The Project Controls team is responsible for administering change requests including the oversight to flow changes into the affected documents and systems and moving the change through the approval steps. Approved changes may impact the future PV profile and BAC for tasks that are either in progress or planned. Except for authorized retroactive changes as described above, changes are implemented by updating the PV profile, BAC, and schedule for the applicable work packages going forward and will not alter the current SV or CV.

Each LCR that receives the appropriate final approval based on its classification is implemented by Project Controls. The change requested in the LCR is incorporated into the Cost and Schedule Baseline. If a LCR requires changes to be made to the risk register, then the Risk Management Team must be notified. Project Controls maintains the Baseline and a Baseline Change Control Log that records and manages the changes to the Integrated Master Schedule (IMS), Performance Measurement Baseline (PMB), Contingency, MR, and Undistributed Budget (UB). This log (Document-14547) is in the LCR Files collection (Collection-3122) in Docushare. The details behind each LCR processed will also be housed in this collection. Each LCR saved will include a Before/After comparison and backups from Primavera and Cobra as standalone files saved to the collection.

Sequence Number	Change Control ID	Description	NSF Approval Date	Risk ID	Affected WBS/Control Account	Implementation Baseline	Schedule Impact	PMB (BAC) Distributed Budget	Contingency Change	*Puts* (\$)	*Takes* (\$)	Authorized Contingency Balance	Total Contingency	% Cont	TPC	modified Contingency Change
99	LCR-505	Secondary Fiber Path Budget		NA	1.02C.00.03	January-16	None	396,340,050	-	-	-	7,354,558	74,802,617	18.9%	\$ 471,150,675	\$ -
100	LCR-507	Update T&S resource NewWire TS 4 start date		TS-283	1.04C.01.01	January-16	None	396,384,668	(36,810)	-	(36,810)	7,317,946	74,786,007	18.9%	\$ 471,150,675	\$ (36,810)
101	LCR-508	Return budget for T&S Procurement Administrator to		TS-283	1.04C.01.01	January-16	None	396,323,752	60,915	60,915	-	7,378,862	74,826,923	18.9%	\$ 471,150,675	\$ 60,915
102	LCR-507	Correction to Update T&S resource NewWire TS 4 start date		TS-283	1.04C.01.01	January-16	None	396,259,062	64,691	64,691	-	7,443,552	74,891,613	18.9%	\$ 471,150,675	\$ 64,691
103	LCR-509	Update T&S Laser Tracker purchase date to FY18		PMO-271	1.04C.14.01	January-16	None	396,266,890	(7,828)	-	(7,828)	7,435,724	74,883,785	18.9%	\$ 471,150,675	\$ (7,828)
104	LCR-510	Add New Account for T&S Summit Construction A&E activities		NA	1.04C.03.01	January-16	None	396,266,890	-	-	-	7,435,724	74,883,785	18.9%	\$ 471,150,675	\$ -
105	LCR-518	Coating Chamber later		TS-283	1.04C.09.02	January-16	None	396,305,704	(38,813)	-	(38,813)	7,396,910	74,844,971	18.9%	\$ 471,150,675	\$ (38,813)
106	LCR-519	Reschedule Hexapod/rotator contract payment milestone		PMO-271	1.04C.05.04	January-16	None	396,201,959	3,744	3,744	-	7,400,655	74,848,716	18.9%	\$ 471,150,675	\$ 3,744
107	LCR-513	M2 Cell Weldment Thermal Stress Relief		TS-076, TS-206	1.04C.06.04	January-16	None	396,486,820	(184,861)	-	(184,861)	7,215,794	74,663,855	18.8%	\$ 471,150,675	\$ (184,861)
108	LCR-533	DM Mid Cycle replan for W16		NA	1.02C.06.02, 1.02C.05.01	January-16	None	396,486,804	16	16	-	7,215,810	74,663,871	18.8%	\$ 471,150,675	\$ 16
109	LCR-515	Create New Work numbers for 1.04C.12.06				February-16	None	396,486,804	-	-	-	7,215,810	74,663,871	18.8%	\$ 471,150,675	\$ 0
110	LCR-517	Create New Work Packages for 1.04C.14.02		NA	1.04C.14.02	February-16	None	396,486,804	-	-	-	7,215,810	74,663,871	18.8%	\$ 471,150,675	\$ -

Figure 6.1 Example of the LCR Log

6.1.1 Integration with Primavera [Guideline 32]

Each LCR that has a Cost and or schedule impact will be modelled in Primavera under a project named after the LCR being evaluated. It is important to evaluate each change request individually to understand the true nature of the cost and schedule impact.

Each Primavera LCR projects that has a cost impact will be integrated with Cobra to evaluate the time phased budget changes to the PMB. The delta will be attached to each change request for review and approval by the CCB. All approved LCRs will be replicated into the Primavera PMB and integrated into Cobra as the start of the month end process.

6.1.2 Integration with Cobra [Guideline 29, 32]

Each LSST Cobra file will be created from the previous month's file and saved with the naming convention of LSST ME YY-MM. Once the file is saved the Cobra the Primavera PMB with the months LCRs implemented will be integrated into Cobra.

After implementing and validating the LCRs in Cobra the Cobra calendar will be advanced to the next



reporting period. Status will then be integrated from the schedule and actuals loaded from the CAS cumulative to date export.

6.2 Maintenance and Archival

All copies of historical Cobra and Primavera projects are maintained as live versions available for interrogation in eCAM. The databases for these systems are archived by IT and .CMP and XER archives are made to ensure quick recovery of data.