LCLS Project Management Document # 1.1-021	Project Management	Revision 0.0

Earned Value Management System Cost Estimating Procedure

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Change History Log

Rev Number	Revision Date	Sections Affected	Description of Change
0.0	03/22/2006	All	Initial version released.

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Cost Estimating Procedure

1.0 PURPOSE

This document describes the process used to develop a cost estimate or a bottom up estimate to complete for the LCLS project following all guidelines in the LCLS Project Execution Plan, Project Management Plan, and Earned Value Management System Description.

2.0 SCOPE

This procedure applies for the entire life cycle of the LCLS project whenever cost estimate data is required to be generated. This procedure is used at the beginning of the project to establish an initial estimate used as the basis to develop the schedule and cost baseline. It can be used periodically throughout the life of the project to more thoroughly assess the remaining work on the project or as part of a baseline change request.

3.0 REFERENCES

LCLS Project Execution Plan, Section 5, Resource Requirements

LCLS Project Management Plan, Section 5, Cost and Labor Estimates

LCLS 1.1-015 Earned Value Management System Description, Section 1, Project Organization and Preliminary Planning

LCLS 1.1-018 Control Account and Work Package Planning Procedure

LCLS 1.1-019 Change Control Procedure

LCLS 1.1-020 Project Schedule Procedure

LCLS 1.1-022 Monthly Status and Reporting Procedure

LCLS Basis of Estimate Criteria (Section 5.2)

LCLS Contingency Estimating Guidelines, Design Maturity and Judgment Factors (Section 5.3)

4.0 DESCRIPTION

The cost estimating methodology used on the LCLS project is a bottom up process based on the foundation of a logically networked schedule that is resource loaded at the lowest activity level. The schedule used for the cost estimate must reflect the scope of work as defined in the LCLS WBS and support all key event milestones. Standard estimating guidelines and methodologies are used as part of the process.

These components of (1) a resource loaded schedule that (2) reflects the scope of work and (3) uses standard estimating guidelines and methodologies is a key part of the

development process. This approach is used to ensure that the cost estimate is based on a reasonable schedule foundation using approved estimating factors; the schedule activity resource amounts are used to generate the time phased cost estimate based on the activity start and finish dates. All estimates are assessed in dollars in the actual year spent.

All estimating guidelines and methodologies are established by the LCLS Project Office and implemented through the LCLS project control team.

This process assumes that all required labor, material and procurement types have been identified and the rates and burdens for each type have been developed. It also assumes that the applicable managers have determined the labor, material, and procurement requirements needed to support the scope of work.

The cost estimating process is illustrated and described in Section 5. Note that the acronym PMCS is used to identify the LCLS project management control team in the process flow charts.

5.0 PROCEDURE DETAILS

5.1 Developing a Detailed Cost Estimate

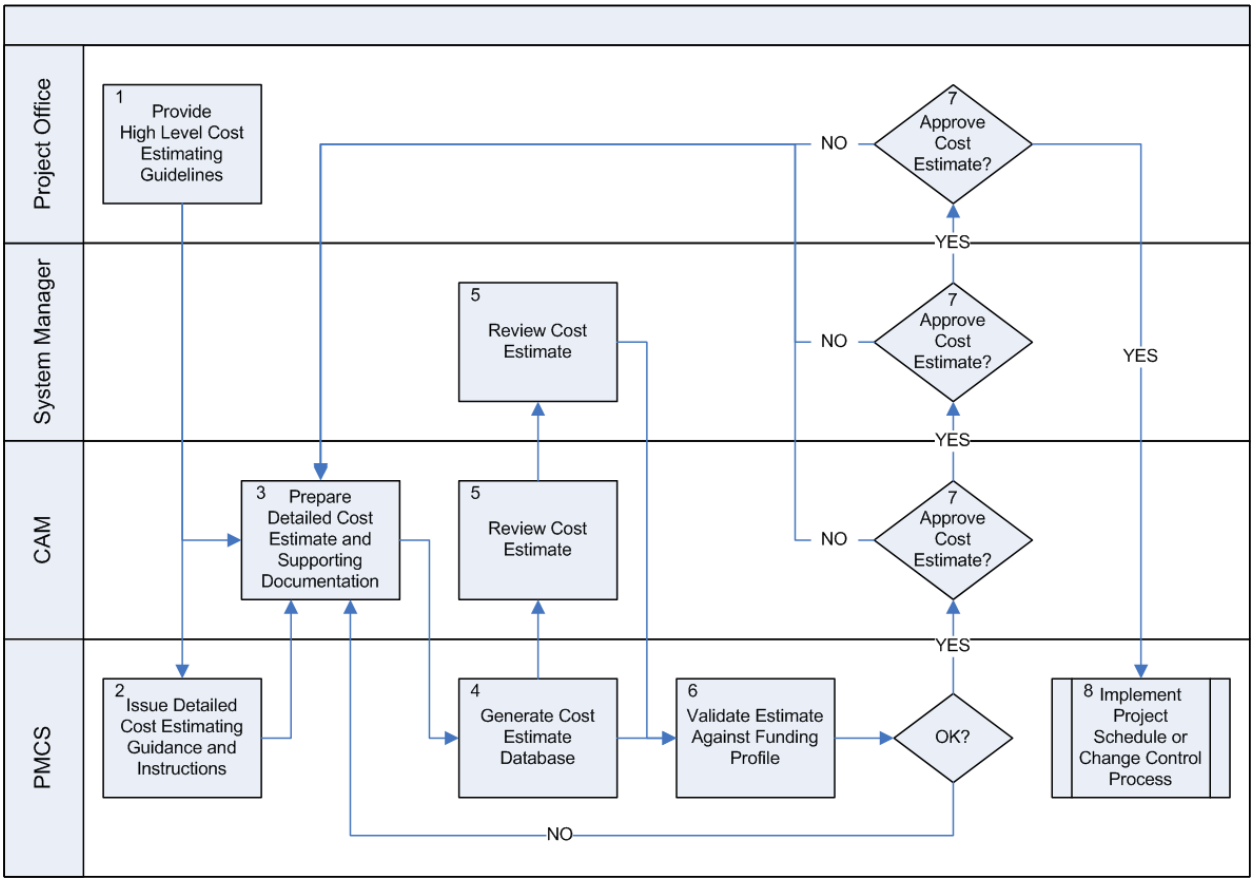

Figure 1. Developing a Detailed Cost Estimate

Step 1 Provide High Level Cost Estimating Guidelines

Responsibility: Project Office

The Project Office is responsible for identifying and describing all high level requirements that the LCLS project must follow when a cost estimate is created. This can include, but is not limited to:

- Funding requirements or restrictions;
- Schedule requirements or restrictions;
- Contingency requirements;
- Direct, overhead, fringe, and other rates;
- Escalation factors.

Step 2 Issue Detailed Cost Estimating Guidance and Instructions

Responsibility: Project Control Team

The project control team is responsible for applying the high level guidance provided by the Project Office. They are responsible for developing applicable guidelines, establishing any conventions and standard methods, and related instructions that others on the project will use to create the cost estimate data. These guidelines and instructions are important to ensure a consistent and disciplined process is used. It is equally important to be able to ascertain how estimate numbers were determined; this basis of estimate provides valuable information in the event estimate numbers need to be revisited later in the project. Basis of estimate information is also useful for planning and estimating future projects.

This guidance can include, but is not limited to:

- Basis of Estimate guidelines;
- Data source files and templates;
- Schedule foundation for completing the cost estimate;
- Resource breakdown structure (RBS) of approved resources.

Step 3 Prepared Detailed Cost Estimate and Supporting Documentation

Responsibility: Control Account Manager

Following the high level guidance provided by the Project Office and the more detailed guidance provided by the project control team, the control account managers prepare the detailed cost estimate and supporting documentation (the basis of estimate). As part of this process, the control account managers identify the:

- Schedule activities that are fully resource loaded and integrated (all labor, material, and procurements have been identified);
- Basis of estimate criteria used for each activity (see Section 5.2);

- Design maturity factor used for each activity (see Section 5.3);
- Judgment factor used for each activity (see Section 5.3).

Step 4 Generate Cost Estimate Database

Responsibility: Project Control Team

Using the cost estimate data provided by the control account managers, the project control team inputs the data into an offline schedule and cost database. This ensures that the cost estimate data are always kept separate from any baseline data during the development process. Detailed and summary reports are then generated from the data which show the new cost estimate and the contingency required.

Step 5 Review Cost Estimate

Responsibility: Control Account Manager, System Manager

The control account managers and system managers review the reports. Corrections or updates are discussed and provided to the project controls team as needed until a cost estimate is generated that all parties are satisfied with.

Step 6 Validate Estimate Against Funding Profile

Responsibility: Project Control Team

As part of the estimate process, the project control team verifies that the cost estimate does not exceed the yearly funding profile. This is an important step to ensure the work as estimated is within the funding parameters of the project. If the cost estimate exceeds any funding parameters, the cost estimate is returned to the control account managers to make the necessary adjustments. The process returns to Step 3.

If the cost estimate is within the funding parameters, the process proceeds to Step 7.

Step 7 Approve Cost Estimate

Responsibility: Control Account Manager, System Manager, Project Office

This is a successive final review and approval of the cost estimate. It begins with the control account manager and ends with the Project Office.

At this stage in the process, the named party can do one of two things:

1. Reject the cost estimate. When this occurs, the process returns to Step 3.
2. Approve the cost estimate. When this occurs, the approval process moves up the approval chain. When the Project Office approves the estimate, the process proceeds to Step 8.

Step 8 Implement Project Schedule or Change Control Process

Responsibility: Project Control Team

Depending on the needs of the project, the next step is to:

1. Implement the Project Schedule Process. This is the next step to begin developing the schedule and cost baseline at the beginning of the project.
2. Implement the Change Control Process. This is the next step to begin the process of qualifying required cost changes as part of a Baseline Change Request.

5.2 Basis of Estimate Criteria

The following basis of estimate criteria type codes are assigned to the activities in the schedule used to generate the cost estimate. The purpose of these criteria is to determine the source, and thus the quality, of the estimate.

Code	Type of Estimate	Description
1	Catalog Listing or Industrial / Construction Databases	This category is used when most of the costs in an estimate can be documented from current vendor catalogs or from published or proprietary industrial or construction databases (e.g. RS Means).
2	Documented Vendor Estimate Based on Drawings / Sketches and Specifications	The estimate is primarily based on vendor estimates obtained for the specific item or activity. To the extent possible, these estimates must be written rather than oral. If the latter, they must be documented. Such quotes by a vendor indicate that a design is sufficiently mature that its cost can be independently estimated (i.e., significant detail in drawings and specifications have been prepared), although the quotes will not be taken as an offer to sell at that price.
3	Engineering Estimate Based on Drawings/ Sketches and Specifications	Estimates in this category have the same level of detail available as in (2) above, but the estimates are done by an expert estimator at SLAC or a subcontractor who is not likely to be a vendor.
4	Engineering Estimate Based on Similar Items or Procedures	Estimates are chiefly based on items or activities that have previously been procured or undertaken. The basis for scaling up or down, or "factoring" (e.g. known cost sensitivities) should be documented in the estimate files. Given the variable degree of similarity between components of the current project and of previous systems, judgment must be used in selecting this code or code (5).
5	Engineering Estimate Based on Analysis	Estimates of items or procedures that are different from previous experience, and, while sketches and specifications may exist, the level of detail is not sufficient to qualify for (3) above. Some labor costs, such as assembly of an item not

Code	Type of Estimate	Description
		previously built, may fall into this category. Supporting background for procured items would include, for example, standard costs for fabricating a given material and the mass of material needed.
6	Expert Opinion (Engineering Allowance)	This category should be used for items or procedures having little documented basis for the estimate. It indicates little confidence in the estimate. Its use should be minimized in the final estimate. It may be used as the estimate preparation develops to measure the maturity of the estimate at any given point. Given time constraints on the estimation process, this category may also be used for items or activities that have low dollar value.
7	Existing Lien	A contract has already been awarded.

5.3 Design Maturity and Judgment Factors

Design maturity and judgment factors are also assigned to the activities in the schedule used to generate the cost estimate. These factors further qualify the cost estimate and provide a measure of risk assessment useful for applying a contingency factor to the cost values. The contingency factor is determined by adding the design maturity decimal factor and judgment decimal factor and then converting the result into a percentage. For example:

Contingency Factor = (Design Maturity + Judgment Factor) x 100

or 1.25 + 1.1 = .35 x 100 or 35%

Design Maturity Factors

Factor	Design Maturity, Labor Related Costs
1.45	The task/item is a conceptual design and/or advances the state of the art.
1.35	The task/item is a new design and/or requires some R&D (not beyond state of the art).
1.25	The task/item is a new design, not exotic, being estimated with no prior experience.
1.15	The task/item is a new design, not exotic, being estimated with prior experience.
1.10	The task/item is a modification of an existing design.
1.0	The task/item is fully invoiced/completed.

Factor	Design Maturity, Material and Subcontract Costs
1.35	The task/item has only a conceptual design or scaled from analogous system.
1.25	The task/item has an engineering estimate with sketches only.
1.15	The task/item has an engineering estimate with engineering drawings.
1.10	The task/item has a budgetary quote or is an off-the shelf item.
1.0	The task/item is fully invoiced/completed.

Judgment Factors

These factors provide the means to apply an additional risk factor based other criteria. These factors can range from 1.0 to 1.1, but can be higher under unusual conditions. The risks identified and applied as a judgment factor should be noted in the estimate file.

Schedule Risk	Does the task/item land on or impact the critical path?
Technical Risk	Is the task/item a new design or beyond the state of the art and/or critical to the LCLS?
Other Risks	Are there out-year inflation risks? Are you a buyer in a tight supply economy? Are there exposures to foreign currencies/markets? Is there only one qualified (or strongly preferred) supplier? Does the item require specialty resources? Any other unusual circumstances?