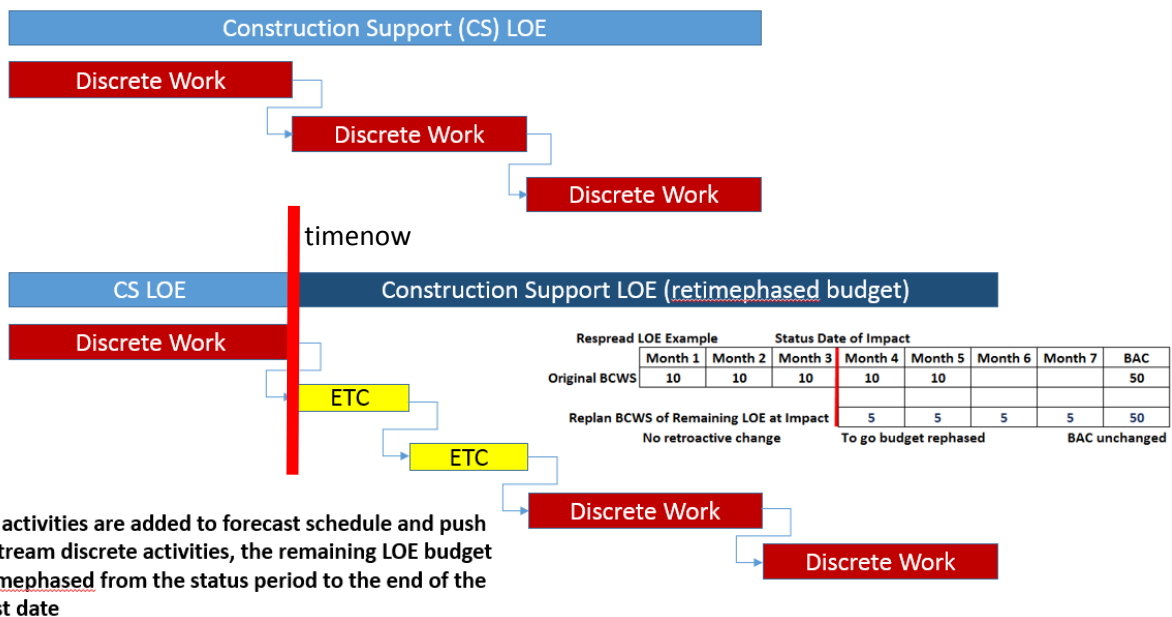


Construction Support (e.g., Title III) as LOE

BLUF:

- 1) Construction support Title III Engineering work scope (T3) and other similar support efforts should be budgeted using the Level-of-Effort (LOE) method.
- 2) If a significant technical/design issue arises during construction, zero budget ETC activities should be added to the forecast schedule and sequenced using precedence logic with the discrete construction work it is impacting. The resultant effect should show the slip/downstream impact to related activity start/finish dates and necessitate the update of cost ETCs. Earned value (or BCWP) for the baseline discrete construction activities shown in the top part of the graphic below can only be claimed when each are successfully completed as shown in the bottom part of the graphic.
- 3) The associated baseline construction support LOE activity (long bar) should be extended to align with the forecasted finish date of the last discrete construction activity with its remaining budget re-time phased in a linear fashion.. The EAC value for the construction support LOE should also be updated. Full earned value (or BCWP) for the baseline construction support LOE activity can only be claimed when the last discrete activity has been completed.
- 4) The handling of Title III Engineering work scope will need to be fully addressed in the Earned Value Management System Description, including the establishment of a threshold level for when ETC activities (aka, zero budget activities) should be added to the forecast schedule.
- 5) The current compliance thresholds of 5% and 1% for the use of ETC activities in the current month and for the total project respectively will continue to be used as a flag for further assessment.

Construction Support (e.g., T3) LOE Model



Statement of Issue:

Title III Engineering and other similar supporting efforts are required during the construction evolution.

Failure to provide this support has the potential to drive discrete construction efforts, however the level of support and timing of specific activities which have the potential to drive discrete effort is unknown at the time of initial Baseline planning. In fact, it is often not known until the point at which it becomes required. The following considerations need to be addressed:

1. Earned Value Considerations: These activities need to be planned and statused within the PMB in order to reflect accurate resource needs and Earned Value considerations.
2. Schedule/Critical Path Considerations: When impacts are identified which impact discrete scope, the impacts must be modeled within the schedule tool to provide accurate critical path analysis.

Title 3 Objectives:

Title III engineering begins at the initiation of procurement action, i.e., the submission of requisitions. It extends from the beginning of the fabrication/construction phase and continues through the completion of construction and equipment acceptance tests. It includes field engineering, problem resolution, configuration control, documentation maintenance, and the technical staff required to maintain all engineering records, including as built drawings at Project completion. It includes the revision of existing design documentation and the generation of any new design documentation required as construction proceeds, engineering analysis to evaluate proposed design changes, and engineering support for inspection, assembly, installation, and testing.

Title I, II, & III are also referred to as Engineering, Procurement, and Construction phases, or EPC. There are discrete “driving paths” through each of these phases that align to DOE Order 413.3 CD gates 1, 2, and 3. During each phase, level of effort budgets are identified for readiness-to-serve work scope. As an example, during the construction phase, Title III engineering work scope is defined as “Construction Coordination Costs” (this per DOE Guide 413.3-21A, “Cost Estimating Guide”, Section 6.4.2.7). This work scope is considered level of effort because of the support/services it provides to the project.

Recommended Solution:

Retain LOE designation for T3 readiness to serve support work scope utilizing ETC forecast activities in the schedule once specific T3 work exceeding a pre-defined threshold is identified. Thresholds would be project-specific, depending on project size and complexity. The initial concern and PM-30 LANL finding in 2017 centered on LOE work scope driving discrete work scope. This was from a scheduling standpoint. While discrete work scope with design conflicts rely upon the T3 work scope to resolve engineering design issues on an as needed basis during the construction phase, the handling of conflicts using ETC forecast activities embedded with the discrete work scope in the schedule to reflect the activities needed for resolution while technically being performed by the LOE account become essentially discrete as they are associated with the performance of the baseline plan. In essence they become discrete (albeit un-budgeted) activities in the schedule by the very nature of their usage. Technically speaking,

a non-resourced/ETC only activity has no performance measurement designation, neither discrete nor level of effort because it has no budget. Therefore, the LOE work scope activity is not driving the discrete work scope activity, which was the initial concern of the PM-30 LANL finding. Following this approach, the contractor will need to be diligent in maintaining the readiness-to-serve LOE work scope. At no time should the T3 LOE work be allowed to achieve 100% complete prior to the underlying discrete work being 100% as well. For example, if the resolution of engineering design issues extends the forecast schedule for the affected discrete work beyond the baseline schedule, the contractor will be required to use its formal change control process to re-baseline (not increase) the remaining budget of the LOE work scope to its completion to align with the forecasted schedule extension of its associated discrete work. Using non-resourced/ETC only activities will also provide added visibility into the T3 work scope efforts, the where, when, and how much. This can be valuable information for decision making and future cost estimates.

- Q1. Is it EIA-748 Compliant? Yes
- Q2. Is it consistent with EFCOG? Yes
- Q3. Is it practical, effective, and cost efficient? Yes
- Q4. Does it position the EVMS as a management decision making tool? Yes
- Q5. Level of impact on current contractor operations? Minimal to none.

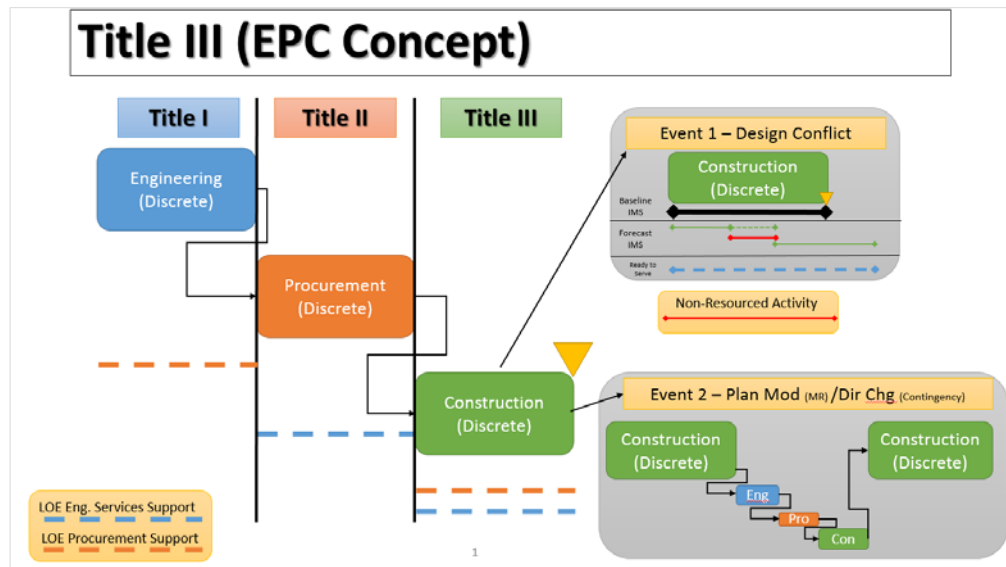
In the illustration below, the T3 “Construction Phase” represents the discrete construction scope, with readiness to serve support. “Event 1 – Design Conflict” represents an event where discrete construction scope experiences a design conflict. When this occurs, readiness-to-serve work scope will be used to help identify and resolve the design conflict. For example, a design conflict may require the project to revise a drawing to capture an as-built condition, specifically, this could be a situation where a pipe hanger could not be physically installed per the approved drawing due to constraints created by a physical constraint like placement of a wall or piece of equipment which prohibits installation per original approved drawing.

For purposes of EVMS, the delay and possible cost overrun is reflected in the baseline plan through an unfavorable schedule variance until the conflict is resolved and the entire work scope is completed which could result in an EAC increase. The forecast IMS will reflect the conflict using “Non-Resourced”/“ETC Only” activities which are logically tied to other discrete construction work scope activities to reflect the delay and possible impact to the project critical path and overall timeline. The EVMS would record and report performance impacts in the form of a schedule delay and probable cost inefficiencies and EAC adjustment until the conflict is resolved and the construction work scope having the conflict is completed. The readiness to serve support would be adjusted to align with the discrete BCWR and remaining duration of the discrete construction work scope.

“Event 2 – Plan Mod (MR)/Directed Change (Contingency) reflects plan modifications for new scope to the distributed PMB but within the CBB (i.e., in-scope to the contract; risk realization/MR utilization), or the customer has directed a change to the plan (i.e., out-of-scope

to the contract; contingency utilization), in both cases requiring the use of the EVMS change control process, and the distribution of budget and additional IMS activities.

Special Note: T3 support scope may represent between 1% and 3% of the total project cost. Of that percentage, “Event 1 – Design Conflict” is estimated to be ~85%, with “Event 2 – Plan Mod/Dir Chg.” making up the ~15% balance.



Counter Thoughts:

1. **Classify T3 work scope as Apportioned Effort.** This appears to be the preferred option of the EFCOG developed whitepaper. The collection of T3 readiness to serve support work scope using an Apportioned or Apportioned-like EVT is problematic in that the apportioned method budgets and measures the earned value for the work effort in direct proportion to the apportioned discrete work scope. T3 readiness to serve support work scope is not directly proportionate to the budget of the discrete work scope in which it supports as the frequency and magnitude of conflicts are an unknown.
2. **Assessment of performance measurement (BCWP) based on the PERT/cost method.** Using the PERT/cost method to calculate BCWP is problematic because it could dramatically overstate the performance of T3 readiness to serve support work scope when the EAC is not updated in a timely manner and the ACWP is allowed to rapidly accumulate. The process would require contractors to develop and maintain a “bottoms-up” EAC every month for the process to be effective, which could be burdensome and costly on large projects. The PERT/cost method is designed to assess performance for low-value bulk material purchases. The use of the PERT/cost method for the assessment of T3 readiness to serve support work scope will result an inaccurate BCWP that overstates the amount of performance being accomplished. In addition, if T3 readiness to serve support work scope can drive other discrete work scope and the critical path, the

use of a mathematical formula seems inappropriate and inadequate. Furthermore, although the % complete of T3 readiness to serve will always match the % complete to the discrete work EAC, the true performance and progress of T3 readiness to serve support non-resourced/ETC activities in the forecast schedule will not translate to the true performance of the project as being told by the EVMS metrics. This will place all attention on adjusting the EAC value and solely using the forecast schedule as the preferred management tool for reporting and decision making.

The PERT/cost method of BCWP calculation is as follows:

Divide the actual cost of work performed (ACWP) by the estimate at complete (EAC), then multiply the quotient by the budget at completion (BAC) or $BCWP = (ACWP/EAC) \times BAC$.

