Earned Value—The Next Generation—A Practical Application for Commercial Projects

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1.0 Introduction

Earned Value systems are one of the most useful and meaningful tools used to status, report, and analyze project cost, schedule, and performance. Unfortunately, their important benefits have too often been lost because earned value systems are thought to be too complex and costly to implement for many commercial projects. In part, this has occurred because earned value systems were originally invented to solve very real project measurement problems in complex cost-reimbursable programs. Thus, they have traditionally been *cost-centric*, reflecting the high priority that cost assumes in cost-reimbursable contract environments. But in many projects, *time* is the highest priority resource. Indeed, so important is time that it has become one of the most important elements of quality in modern business practice.

This paper describes an earned value system that is a simple and practical program management tool to influence programmatic behavior when applied to *time-centric or time-constrained* projects. The essence of the technique is to "earn" task starts and finishes. Thus, task leaders are measured on the "earned value" of "starts and finishes" of project tasks; and, the project manager's measurement focus is directed toward *accomplishment of tasks* necessary to achieve results in the *time allowed* for achieving the scope of the project. But, the principal benefit obtained and *compelling reason to employ this tool is that the application of earned va lue stimulates project improvement* to the betterment of the project objective.

2.0 Traditional Earned Value Measurements

The purpose of earned value is to *measure accomplishment* of the project's scope and objective, and *predict outcome* at completion, using units of measure which are at the core of the value system of the project. Traditionally, the core value has been money, and the focus has been cost. When used to measure project progress with cost metrics, the typical measurements are given in *A Guide to the Project Management Body of Knowledge* in Chapter 10.

But, there are many reasons why it is difficult, essentially impractical, to apply these conventional earned value measurements in commercial projects. They include: no time card or time accounting system, poor timecard compliance even when it exists, no job numbers, no overhead calculation

Exhibit 1. Earning Rules

Rule	Definition or Application
A Finish is:	Valued as 1 or 0. The task has completed its scope; the scheduled successors to this task can begin work as planned in the schedule network.
A Start is:	Valued as 1 or 0. The first task under the work element summary task is started; generally this means that the predecessor tasks are completed, task is properly staffed, resources are in place, and effort has begun to be applied in a meaningful manner; incidental activity is not credited as a start.
Partial credit	A task is either started or it is not started; it is finished or it is not; there is no partial credit for progress toward finish; incidental starting activity is not "counted"; all WBS deliverables are completed.
Un-weighted Credit	For the simplest system, all tasks are weighted equally, 1 or 0 for the start and for the finish
Weighted Credit	For a more complex system, there are multiple methods for applying weight. For instance, weight heavily the tasks that are on the critical path. Lesser weight could be given to tasks that are not critical, but have little slack, and thus are candidates to become critical [thus they are "near critical" from a risk perspective]. Or, effort can be evaluated in advance and planned into the schedule, so that tasks are weighted according to effort [not duration]

Exhibit 2. Process Steps for Time-Centric Earned Value

Steps	Step Deliverable	Who Does It?
1. Construct WBS of Product Nouns	Hierarchical WBS	Project Manager & WBS element managers
2. Write Tasks for actions necessary to produce nouns	Verb-led statement of work for the WBS element	WBS element managers with work element team members
3. Schedule and network tasks with definitive start and end dates; add resource constraints; conduct risk analysis with Monte Carlo techniques, and establish risk weighted dates. Determine critical and near critical paths	CPM Network of tasks with risk evaluation and resource plan	Project Manager & WBS element managers
4. Establish Earning Rules	List of Rules with definitions in a Rules Dictionary [if necessary]	Project Manager
5. Claim earnings of starts and finishes periodically as appropriate	List of claimed starts and finishes	WBS element manager
6. Validate Claims; Analyze data for trends, predict completion	Validation reconciliation & Analysis	Project Manager or administrator
7. Create report of Variances and analysis	Report	Project Manager or administrator

or cost allocation system, no ledger for associating cost with projects, and many other reasons. So, in spite of recognized benefit, the redesign of the business to overcome these "deficiencies" is often impractical.

For many commercial projects, cost, at least product or service development and launch cost, has a much lower priority than time or performance, the other two elements of the triple constraint. A prominent example of a higher priority element is time-to-market for a new product or service (Shiba, Graham, Walden 1993, 10). Therefore, there is a need to focus earned value management technique on the core value of time.

3.0 Earned Start-Finish System

The Earned Start-Finish system is time-centric. In a time-centric system, the purpose is to "earn" the time elements of the project plan, specifically answering the two questions: are tasks starting on time; are they finishing on time? This "start-finish" time-centric system retains the most important features of the cost-centric approach: that is, a focus on accomplishment; measurement of performance against plan; and a predictive outlook on completion.

3.1 Time-Centric System Structure and Components

The time-centric earned value system is a simple one of measuring, analyzing, and reporting on task starts and finishes. Like the cost-centric system, the time-centric system depends on the information contained in the WBS [nouns, deliverables], the project tasks [verbs], and project schedule [tasks ordered by time, linked by relationships]. Each task within the project schedule is aligned with a deliverable of the WBS, and measured by its success of delivering a "deliverable" of the WBS. So, in order to be able to claim success a task must start and must finish. But, how are claims to be measured? Successful project teams define *both* the *rules of measurement* and the *metrics or measurement systems that go with the rules*. The recommended "accounting" rules are given in Exhibit 1.

3.2 Process Steps for Time-Centric Earned Value

Process steps necessary to implement a time-centric "start-finish" earned value system are given in Exhibit 2.

3.3 Graphical portrayal of the system

An example project is outlined in Exhibit 3 and shows the planned, unweighted, project starts and finishes. Exhibit 4 shows this same data as cumulative *planned* starts and finishes, and includes the cumulative *actual* starts and finishes for this example. Using two information elements, the slope of

Exhibit 3. Planned Tasks, Example Project

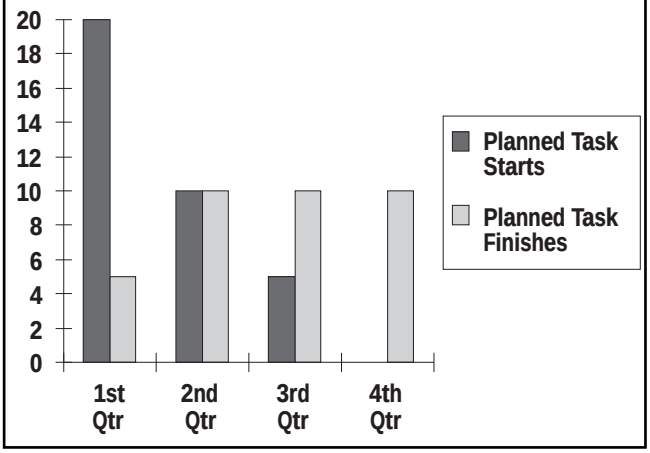


Exhibit 4. Example Actuals vs. Planned Performance

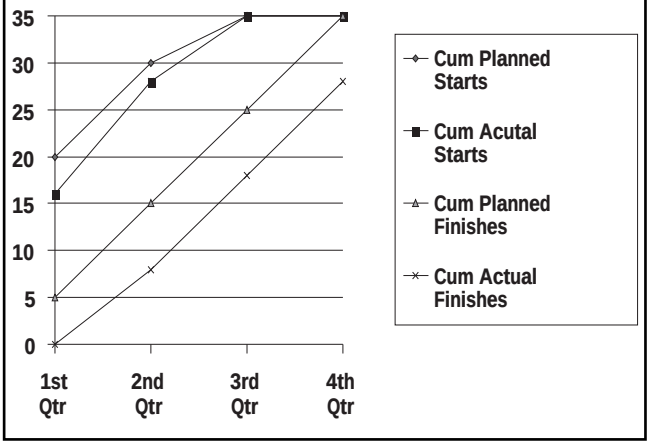
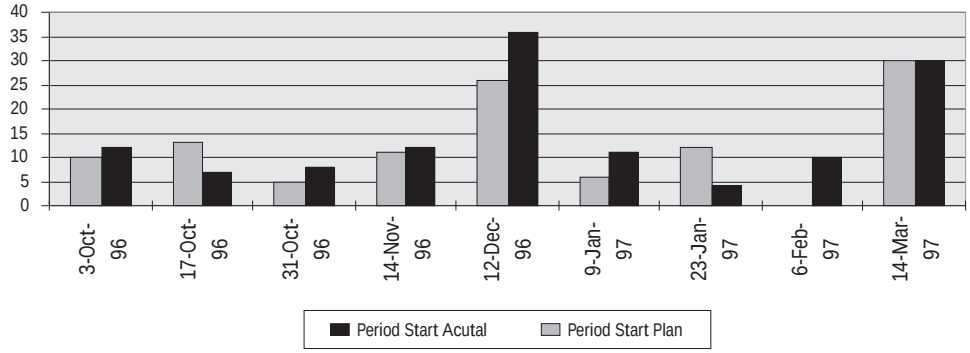


Exhibit 5. P2000 Project Planned and Actual Starts



the cumulative curve, and the remaining starts and finishes, actual start and finish dates can be *predicted*.

For instance, from Exhibit 4, the following is data is available: At the beginning of the first quarter, there is a variance of (four) task starts, sixteen actual vs twenty planned. Four starts were not earned. However, after the end of the first quarter, twenty-eight task starts are claimed, and credited. The *slope of activity in the first quarter is greater than planned* as shown by the steeper curve. In fact, ten starts were planned in the period, and twelve were claimed, for a total of 16+12=28 starts claimed at the end of the second quarter. Within the resolution of the graph, for the third quarter, with only seven tasks remaining to start, and a productivity of 12/quarter, it is *predictable* that the project will "complete" all of the starts on plan. A similar analysis comes from the slope of the actual finishes. The actual curve is consistently seven tasks behind. The project is *predicted* to finish near the end of the next quarter.

The earned start-finish system is more limited as a management tool for prediction than the cost-centric system. Limitations arise because cost is not included in the earned value equation, and so not all of the information potentially available in a project is used. *But, this limitation can be mitigated by having a high degree of granularity in the project scheduling, thereby reducing the predictive errors in estimating the future from past performance.* Predicting the project outcome is also a component of analyzing the project risk. In fact, risk analysis of schedule-limited projects is many times a risk analysis on cost or performance risk (Hulett 1997, 53), even these risk elements may not be directly measured.

Predictive behavior assumes that performance index of any given task is related through the project work package environment and summary tasks to the performance index of other tasks. If all tasks are independent, then, of course, the completion of one task does not predict the completion of another task. But, this limitation is common to the predictive

Exhibit 6. P2000 Cum Starts Planned and Actual

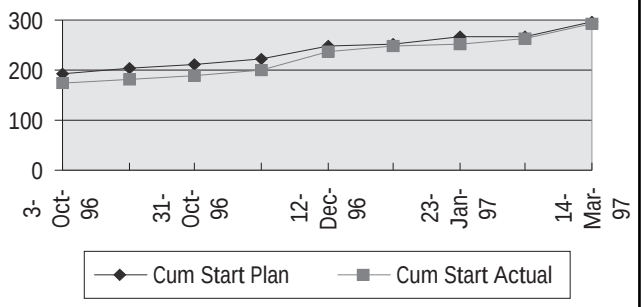
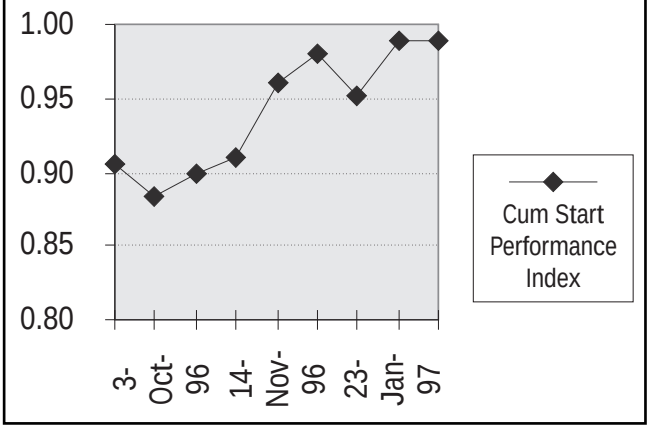


Exhibit 7. P2000 Cum Start Performance Index



aspects of all earned value systems. As with all predictions, the extrapolation assumes that recent behavior in the past will be repeated in the near future.

Thus, the best use of all earned value systems is stimulate project improvement activity.

4.0 Applying the System

Process-2000 is a project on-going within Lanier Worldwide, an office products-and-services sales and distribution company within the Harris Corporation. Elaborate labor-hour cost accounting systems for internal operations is not justified by its business model. However, Process-2000 is a complex project to be managed, involving the activities of over fifty dedicated staff members, and the insertion of numerous technology and process improvements within Lanier in a time-constrained framework. Therefore, the Process-2000 project uses time-centric earned value reporting.

4.1 Process 2000 project results

Process-2000 is controlled at the summary level with a networked chart of approximately 500 tasks arranged in a hierarchy. At the top of the hierarchy are a limited set of *program events* that represent the most important business imperatives of the project. Below them are the traditional summary and detail schedules. Finish-Start and Start-Start relationships are allowed; no Finish-Finish, Start-Finish, or time-constrained tasks were allowed. This facilitates identification of project dependencies, helps identify the true start and finish, and enables good statistical risk analysis. An "Earned Start-Finish" report on these 500 tasks are provided each month to the Project Manager. Exhibit 5 through Exhibit 10 are charts of the period and cumulative data of six months of activity. Included are the performance indexes of the cumulative actual performance normalized to the cumulative planned performance. Performance indexes represent the predictive aspects of this methodology and they approximately model the schedule performance index of the cost-centric earned value system of BCWP/BCWS

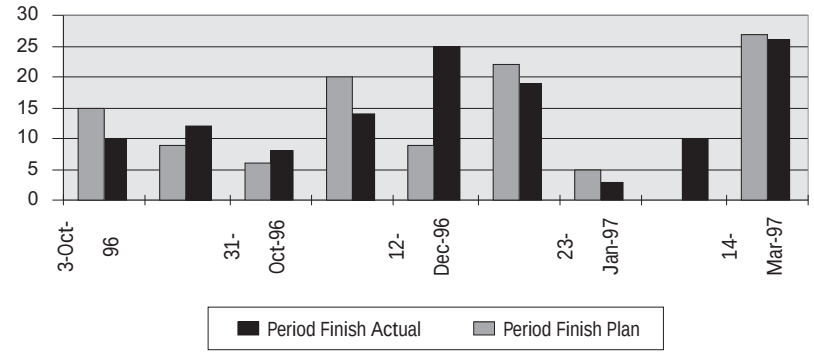
4.2 Conclusions and lessons learned from P2000

Consider this thought from Henry Wadsworth Longfellow: "Great is the art of beginning, but greater the art of finishing". We found at Lanier that it is much easier to start a task, or at least to claim credit for starting, than to finish. Consistently, our data shows starts more close to plan than finishes. And, in fact, we found that as John Galsworthy, English novelist said, "beginnings are always messy". That is, it is relatively easy to claim a start based on a meeting or a phone call, but has the task really started? So, it is important, as part of the rules, to establish when task activity has really started. Finishes are better behaved because the deliverable is often tangible.

We found that a constant and consistent focus on getting started and getting finished did indeed stimulate project improvement. Many tasks were reconsidered more carefully in the network of the project plan as the metric became better understood. The predictive nature of the curves did indeed stimulate project improvements to overcome missed milestones. Happily, these improvements invalidated predictions based upon past performance extrapolation.

The maintenance effort to keep the data current is much less than in cost centric system simply because there is less of it. However, the debates between Project Manager and Work Element Manager over "claims" were similar to those experienced with cost-centric systems.

Exhibit 8. Planned and Actual Finishes



We developed this methodology because we were looking for an approach that kept the entire project team focused on key milestones and at the same time, provided estimate at completion (EAC) visibility to the project management team. Since our projects are time critical, we needed a way to obtain project status as painlessly as possible. The "earned value" system described in this paper helped us achieve these goals. Collecting data on task "starts & finishes" proved to be a straight forward way to status projects and maintain milestone focus. This methodology also provides the measure of predictive outlook based upon past performance we require. Since predictions do stimulate management alternatives, this information is used to improve project performance. The success of the system so far is that Lanier will continue to apply the principles in future projects.

Exhibit 9. Cum Finishes Plan and Actual

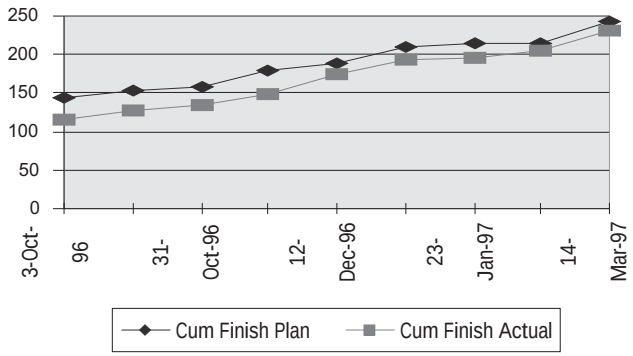
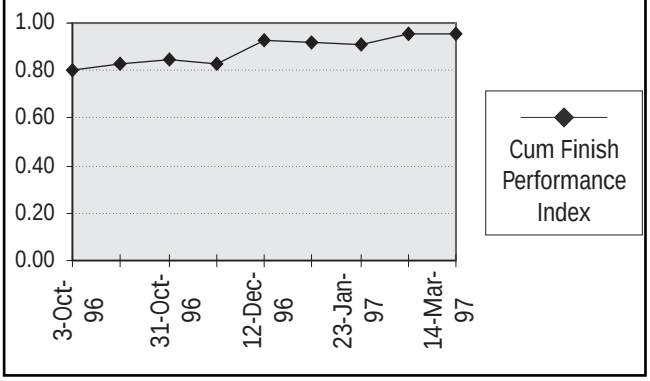


Exhibit 10. Cum Finish Performance Index



Article

Hulett, David T. 1997 Revisiting "What is a Project" From the Risk Analysis Perspective. *Program Management Journal* Vol 28, Number 1 (March): 53-54.

Book

Shiba, S., Graham, A., Walden, D. 1993 *A New American TQM, Four Practical Revolutions in Management*. Cambridge, Ma: Center for Quality Management