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Earned Schedule
Schedule Analysis from EVM Measures

Editor's Introduction: The 100% Rule described in the previous article ensures that no work is missed in the development of a project WBS and the resulting schedule. These ingredients are key to a project manager's ability to gather Earned Schedule data, as described in this previously unpublished article.

Earned Schedule (**ES**) is a method of deriving schedule performance from Earned Value Management (**EVM**) data [1]. The ES indicators are time-based, unlike the cost-based EVM schedule indicators, Schedule Variance (**SV**) and Schedule Performance Index (**SPI**) [2]. Schedule performance described by time-based measures and indicators is more understandable and offers considerable advantages over the EVM cost approach to schedule depiction. One advantage ES has over EVM is that its indicators, SV(t) and SPI(t), provide reliable information regardless of whether the project is late or early performing with respect to its planned performance. In contrast, the erratic behavior of the EVM schedule indicators is well known: SV = 0.0 and SPI = 1.0 at the conclusion of a late project, falsely indicating perfect performance. The ES characteristic of yielding reliable information throughout the project period of performance facilitates the ability to forecast final duration and completion date … a significant improvement to the EVM practice.

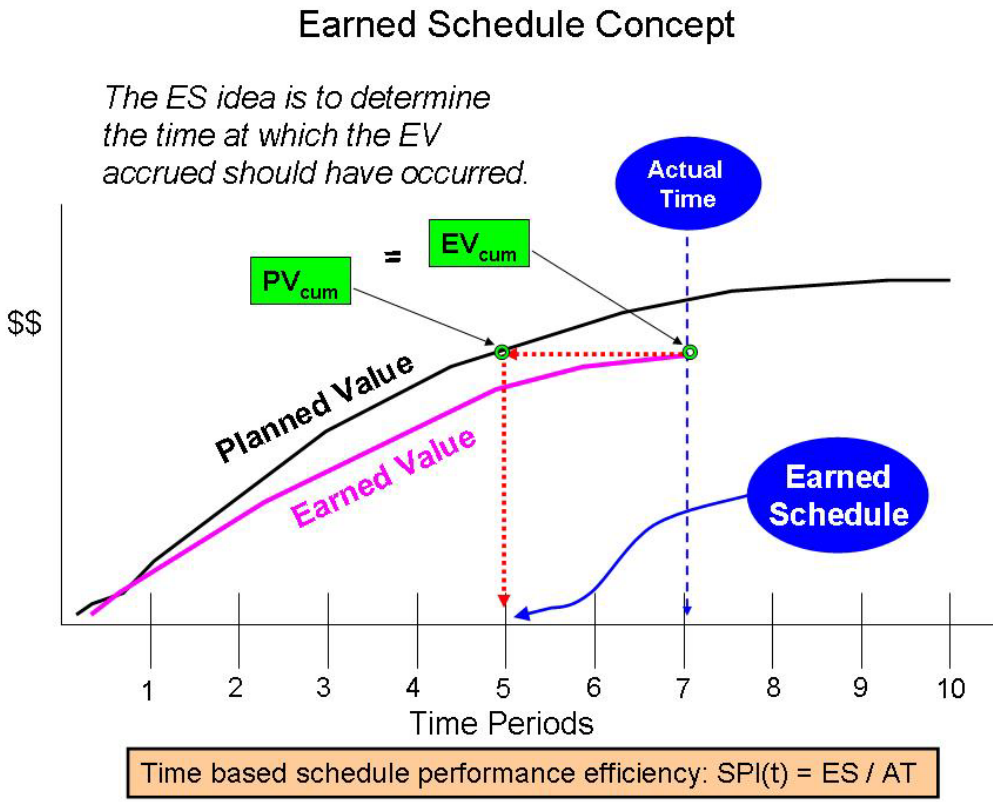
The ability to make schedule forecasts without performing a complete bottom-up schedule analysis of the work remaining has been long desired by EVM practitioners. With ES, project managers and customers have the ability to cross-check the bottom-up estimate of the completion date in the same way that final cost estimates are validated using the Independent Estimate at Completion (**IEAC**) calculations. The simplest expression created for duration prediction, termed the 'short form' equation, is IEAC(t) = PD / SPI(t), where PD is the planned duration for the project [3]. With this forecasting capability, Earned Schedule offers a quantum advance in the practice of EVM and project management … *ES is truly a breakthrough technique*.

The Earned Schedule idea is simple: identify the time at which the amount of earned value (**EV**) accrued should have been earned. By determining this time, time-based indicators can be formed to provide schedule variance and performance efficiency information.

Shown on page 7 is a graphic of the Earned Schedule concept to assist in the description of how the ES measure is obtained. Projecting the cumulative EV onto the performance measurement baseline (**PMB**), diagrammed by the red dashed horizontal line, determines where planned value (**PV**) equals the EV accrued. This intersection point identifies the time duration in which that amount of EV should have been earned in accordance with the schedule. The red dashed vertical line from the point on the PMB to the time axis determines the "earned" portion of the schedule. The duration from the beginning of the project to the intersection of the time axis is the earned schedule (**ES**).

With ES determined, indicators can be formed. It is now possible to compare where the project is time-wise to its accomplishment in ac-

cordance with the PMB. "Actual Time," denoted AT, is the duration at which the EV accrued is recorded. The time-based indicators are easily formulated from the two measures, ES and AT. Schedule Variance becomes SV(t) = ES – AT, and Schedule Performance Index is SPI(t) = ES / AT. In general, the ES terminology follows the convention applied in the previous sentence; i.e., the ES indicators and predictors are distinguished from their EVM counterparts by appending "(t)" (see the Terminology page of at http://www.earnedschedule.com).



For the graphic shown, the measure of ES equals 5 time periods, while the time at which the EV is measured is 7 periods. From these measures, the time-based indicators may be computed as follows:

- SV(t) = ES – AT = 5 – 7 = -2 time periods
- SPI(t) = ES / AT = 5 / 7 = 0.71

The above calculation example was purposely created for simplicity. In actual practice, the ES measure is usually equal to a whole number of periods plus a portion of one period. The fractional portion is determined from a linear interpolation, which is explained in the Concept Description on the ES website.

The preceding is an extremely brief description of the Earned Schedule measure and its associated schedule performance indicators. Supplementary to this introduction, there is a considerable amount of accessible ES information to aid potential users. The concept description, training sources, and knowledgeable contacts are available from the ES website along with published papers, conference presentations and workshop material, all free of charge. Additionally, calculators facilitating the application of ES are available from the Earned Schedule website. The *ES Calculator v1* is very easy to use and is preferred.

The ES concept has demonstrated via the use of notional, real and simulated data to provide the best time-based depiction and forecast of schedule performance in comparison to other EVM data driven methods[4]. Likewise, it is notable that the ES method has rapidly propagated to several countries, including the USA, Australia, United Kingdom, Belgium, and Spain. ES is being used by major defense and commercial projects in the USA and UK. The benefit derived from application of the ES practice is recognized and included in EVM courses as well as new and yet to be released text books and project management tools. With the potential publication of the experiences and empiric study from the expanding practitioner application, coupled with academic research being conducted at the University of Ghent, Belgium, and elsewhere there is expectation of rapid development of the ES "Body of Knowledge."

Over its five years of existence, the ES practice has evolved and expanded to provide additional schedule analysis capabilities. A sched-

ule adherence measure has been created for understanding how closely the project execution follows the planned schedule [5]. The understanding of schedule adherence has, in turn, facilitated analysis of the schedule network to disclose those tasks experiencing impediments or constraints and furthermore identify those tasks which will likely have rework at some future time. The ES practice and accompanying analysis methods have been shown to provide additional insight to critical path analysis as well [6]. A key point is that all of this analysis capability is derived from the EVM measures and the schedule only—*no additional information is required*.

The fundamental concept of ES, its measures and the time-based schedule indicators, are described within the emerging practice insert to the Project Management Institute *Practice Standard for Earned Value Management* [2].

References

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In 2007 Walt Lipke received the PMI Metrics SIG Scholar Award and the PMI Eric Jenett Award for Project Management Excellence for his leadership role and contribution to project management resulting from his creation of the Earned Schedule method. Walt can be reached at waltlipke@cox.net.

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