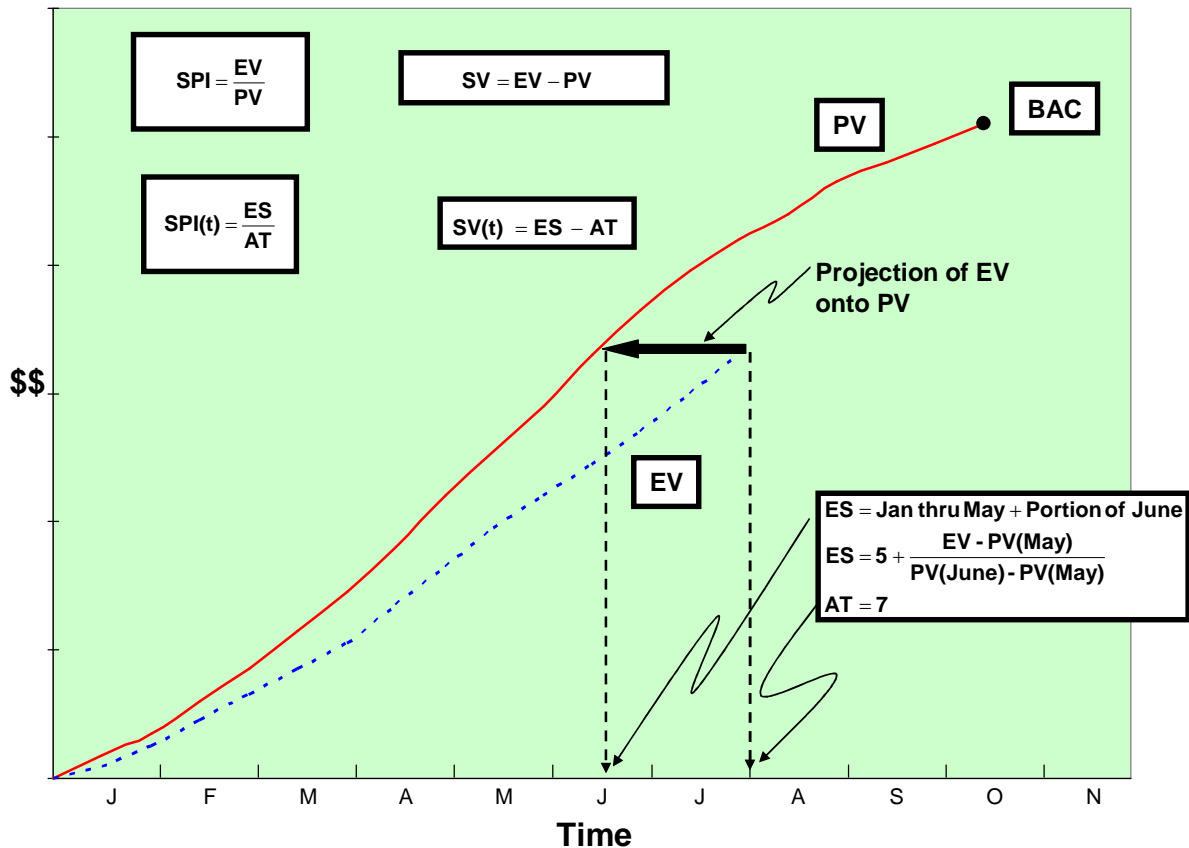# Earned Schedule Concept

The ES idea is a simple one: 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 management information.

The figure below illustrates how the ES measure is obtained. Projecting the cumulative EV onto the PV curve (i.e., the PMB), as shown by the diagram, determines where planned value (PV) equals the EV accrued. This intersection point identifies the time that amount of EV should have been earned in accordance with the schedule. The 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 amount of earned schedule (ES).

$$SPI = \frac{EV}{PV}$$

$$SV = EV - PV$$

$$SPI(t) = \frac{ES}{AT}$$

$$SV(t) = ES - AT$$

Projection of EV onto PV

PV

BAC

EV

$$ES = Jan\ thru\ May + Portion\ of\ June$$
$$ES = 5 + \frac{EV - PV(May)}{PV(June) - PV(May)}$$
$$AT = 7$$

Time

J F M A M J J A S O N

$$

The graphic and the box in the lower right of the figure provide an example of how ES is calculated. As observed from the figure, all of the PV through May has been earned. However, only a portion of June has been completed with respect to the baseline. Thus the duration of the completed portion of the planned schedule is in excess of 5 months. The EV accrued appears at the end of July, making actual time equal to 7 months. The method of calculation to determine the portion of June to credit

to ES is a linear interpolation. The amount of EV extending past the cumulative PV for May divided by the incremental amount of PV planned for June determines the fraction of the June schedule that has been earned.

In more mathematical terms:

- ES_{cum} is the: Number of completed PV time increments EV exceeds + the fraction of the incomplete PV increment

- $ES_{cum} = C + I$
  where: C = number of whole time increments of the PMB for which $EV \geq PV$
  $I = (EV - PV_C) / (PV_{C+1} - PV_C)$

Some people have become confused with the computation of I and make the interpolation over a larger time increment. This method is incorrect. The interpolated portion of ES will always be for one PV time period.

From the diagram it can be deduced that the ES calculation cannot fail when the project is late performing. *(Recall, the EVM schedule indicators do fail for late projects, resulting in an erroneous indication of perfect performance at project completion.)* Imagine the EV line extending past the time point at which BAC occurs, i.e., the planned time for completion. It is easily visualized that no matter how late the project becomes a point on the PMB can always be determined equal to the EV accrued. This assertion is true because the EV accrued will never exceed BAC.

The figure shows both the EVM schedule indicators and those for ES. With ES determined, time-based indicators can be formed. It is now possible to compare where the project is time-wise with where it should be in accordance 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 $SPI(t) = ES / AT$.

While ES could be determined graphically as described previously, the concept becomes much more useful when facilitated as a calculation. Two calculators are available for download from the ES calculator page. The v1 calculator is simpler to apply, but is not quite as accurate as the v2. The difference in accuracy between v1 and v2 ES calculators is negligible after the first few periods of the project have elapsed. Most practitioners use the v1 calculator because of its simplicity.

For a better understanding of Earned Schedule, it is recommended to read the seminal paper, "Schedule is Different." The paper, "Not Your Father's Earned Value," is likewise recommended; it is a very clear, non-technical treatment of the topic. Both papers are available for download from the Papers page.

The 45 minute video, "Earned Schedule - An Emerging Enhancement to Earned Value Management," is no longer accessible for viewing from the PMI Metrics Specific Interest Group website. The MetSIG was dissolved under the reformation of PMI into its virtual communities. However, the slides, presented in the April 2007 MetSIG webinar are now made available on the Presentations page. The link to the slides for the webinar is Introduction to Earned Schedule.