

Apportioned Earned Value Technique (Methodology)

White Paper

Purpose

The main purpose of this white paper is to provide clarity and improve implementation guidelines related to using the apportioned earned value technique (EVT) on DOE Capital Asset projects under DOE O 413.3B¹⁰. The white paper also addresses the appropriate use of apportioned EVT and its advantages in comparison to level of effort (LOE) EVT, specifically the representation of the work and performance.

Background and Assumptions

There are four types of EVT used in EVMS on DOE capital asset projects (CAP): LOE (EVT A), discrete (generally EVT C), apportioned (EVT J/M), and planning package (EVT K). A CAP is a discrete deliverable with a start and a finish; thus, the use of discrete EVT is a given. However, the use of LOE EVT is arguably high masking performance. The use of apportioned EVT and the increased use of discrete EVT should improve project planning and execution.

The DOE Contractor Project Performance (CPP) Upload Requirement Data Item Description (DID) V5-0-1, DS03 Cost, EVT (page 5 of 37)⁹ defines two apportioned EVTs: apportioned (EVT J) and calculated apportionment (EVT M). These two EVTs are similar, and perhaps interchangeable, from an EVMS guideline perspective but vary in implementation process including the cost tool. EVT J simply uses the percent complete from the discrete (base) WP(s) for the apportioned (target) WP(s). EVT M is more robust across various WPs and is flexible in setting up various apportioned to discrete configurations. The focus in this white paper is using EVT M.

Per [GAO-16-89G](#)⁴ & [GAO-20-195G](#)³: *“Apportioned effort is effort that by itself is not readily divisible into short-span work packages but is related in direct proportion to an activity or activities with discrete measured effort. Apportioned effort work packages can be defined as discrete work packages, but apportioned effort tasks are unique because they are closely dependent on another discrete work package.”*

Per [GAO-20-195G](#)³ *“Level of effort reflects earned value for activities that are merely related to the passage of time and have no physical products or defined deliverables...Level of effort should be used sparingly; programs that report a high amount of level of effort for measuring earned value are not providing objective data and the EVM system will not perform as expected. As a general rule, if more than 15 percent of a program’s budget is classified as level of effort, then the amount should be scrutinized. When level of effort is used excessively for measuring status, the program is not implementing EVM as intended and will fall short of the benefits EVM can offer.”*

Apportioned effort will be reflected in schedule variance, whereas LOE does not have schedule variance. Apportioned EVT should be considered for capital asset projects. Use of the apportioned instead of LOE EVT will more accurately measure schedule and cost variances.

The discussion throughout this white paper refers to the apportioned work package (WP) as the “target” WP, while the discrete WP(s) that the apportioned effort supports is referred to as the “base” WP(s) factoring the WPs’ organizational breakdown structure (OBS). There are various scenarios of target/base combinations, with perhaps the most common scenario on DOE capital asset projects as one apportioned WP (target) that supports multiple discrete WPs (base), all in the same control account (CA), unless justified. Another more forward scenario is one-to-one, where one apportioned WP (target) supports only one discrete WP (base). The reverse is also a possible scenario, where multiple apportioned WPs (target) support one discrete WP (base). Although, the many apportioned WPs (target) to many discrete WPs (base) combination is conceptually possible, this becomes more of the first scenario, where one apportioned WP (target) is apportioned to many discrete WPs (base), but several apportioned WPs (target) are in the mix.

Apportioned Effort Development Phases

The first step is to determine the discrete (EVT C) work package(s) (base) that the one apportioned effort (EVT J/M) work package(s) (target) will support. The discrete WPs can have a combination of discrete EVTs. It is important to correlate like-to-like scope when establishing the discrete WP(s) (base) to the apportioned WP(s) (target) relationship and within the same CA), unless justified.

The second step is establishing the basis of estimate (BOE) for the apportioned WP(s) and its relationship to the discrete WP(s). It is then necessary to document the apportioned effort factoring (*“Planned and actual accomplishment is calculated as a percent of the planned and actual accomplishment earned by the prime work package(s)”*⁶), the type and number of apportioned resources needed to support the discrete WPs, and other basis as necessary. The apportioned WP (target) budgeted cost of work scheduled (BCWS) profile(s) should be based on, but does not need to align with, the discrete WP (base) BCWS profile(s).

The third step is planning the Apportioned effort in the schedule tool, then the cost tool. Scheduling will include establishing the apportioned WP, developing tasks and their resources, establishing logic of the apportioned effort tasks and their relationship to the discrete tasks with start-to-start (SS) & finish-to-finish (FF) discrete (base) predecessors to apportioned (target) task(s). The relationships may include lags, as appropriate. The cost tool planning will include setting up the apportioned WP(s) and associating the discrete WP(s) (base).

The last step, as work progresses and discrete WP(s) (base) start earning performance, the apportioned WP(s) (target) earn performance equal to the overall weighted incremental percent complete of the discrete WP(s) (base).

EVMS Consideration and Recommended Guidelines

The apportioned WP must be assigned to discrete WP(s) within the same CA), unless justified. This has the advantage to control the apportioned WP duration, easily trace the discrete-to-apportioned supported scope, and overall demonstrate consistent (like-for-like scope within the CA) and isolated variance and performance analysis at the CA level.

Baseline changes to the base discrete WPs will require changes to the target apportioned WPs.

Like LOE, as support-type tasks, the apportioned tasks should not drive the critical path.

Application of Apportioned Effort vs LOE

LOE assumes BCWP earned with the passage of time and equals BCWS. Apportioned effort BCWP is earned as technical work is accomplished in the discrete (base) and therefore, following the discrete earned performance percent completion. Therefore, by definition, apportioned effort may have schedule variance.

The following example demonstrates a comparison between the planning and earning methodology of both EVTs:

A LOE WP supports a discrete WP(s) and has no objective schedule indicators (e.g., SV - Figure 1). The main criteria for the LOE WP are: 1) document in the BOE the LOE effort required to support the discrete time-phased scope, and 2) align the LOE period of performance to support the discrete effort. The LOE BCWS WP profile could be different from the discrete BCWS WP profile. Earned value for LOE is the same as the planned value.

EVT		Period 1	Period 2	Period 3	Period 4	Period 5	BAC
LOE	BCWS	250	250	250	250	250	1250
	BCWP	250	250	250	250	250	
	% Complete	20%	40%	60%	80%	100%	
	SPI	1.00	1.00	1.00	1.00	1.00	
	SV	0	0	0	0	0	
Discrete	BCWS	1000	100	200	200	1000	2500
	BCWP	800	100	150	200	1250	
	% complete	32%	36%	42%	50%	100%	
	SPI	0.80	1.00	0.75	1.00	1.25	
	SV	-200	0	-50	0	250	

Figure 1: LOE WP

An apportioned WP supports a discrete WP(s) and has objective schedule indicators (Figure 2) based on the discrete schedule performance. The main criterion for the apportioned WP is similar to LOE with the distinction being the earned value for apportioned WP is based on the earned value for the discrete WP(s). The apportioned WP percent complete is the same as the discrete WP percent complete for the period of performance as shown in Figure 2. The apportioned BCWS WP profile could be different from the discrete BCWS WP profile (Figure 3).

EVT		Period 1	Period 2	Period 3	Period 4	Period 5	BAC
Discrete	BCWS	1000	100	200	200	1000	2500
	BCWP	800	100	150	200	1250	
	% complete	32%	36%	42%	50%	100%	
	SPI	0.80	1.00	0.75	1.00	1.25	
	SV	-200	0	-50	0	250	
	SV %	-20%	0%	-25%	0%	25%	
Using Discrete % Complete to Calculate BCWP							
Apportioned (spread as factor)	BCWS	500	50	100	100	500	1250
	BCWP	400	50	75	100	625	
	% complete	32%	36%	42%	50%	100%	
	SPI	0.80	1.00	0.75	1.00	1.25	
	SV	-100	0	-25	0	125	
	SV %	-20%	0%	-25%	0%	25%	

Figure 2: Apportioned WP

EVT		Period 1	Period 2	Period 3	Period 4	Period 5	BAC
Discrete	BCWS	1000	100	200	200	1000	2500
	BCWP	800	100	150	200	1250	
	% complete	32%	36%	42%	50%	100%	
	SPI	0.80	1.00	0.75	1.00	1.25	
	SV	-200	0	-50	0	250	
	SV %	-20%	0%	-25%	0%	25%	
Apportioned (spread per BOE)	BCWS	480	45	85	115	525	1250
	BCWP	400	50	75	100	625	
	% complete	32%	36%	42%	50%	100%	
	SPI	0.83	1.11	0.88	0.87	1.19	
	SV	-80	5	-10	-15	100	
	SV %	-17%	11%	-12%	-13%	19%	

Figure 3: Apportioned WP (different BCWS profile)

Conclusion

Apportioned EVT, as implemented appropriately including when LOE EVT is considered, will improve project planning and execution. Apportioned EVT will help the project team better analyze schedule and cost variances, so impacts are clearly identified, and appropriate corrective actions are established and implemented.

It is important to correlate like-to-like scope when establishing the discrete WP(s) (base) to the apportioned WP(s) (target) and within the same CA), unless justified. The apportioned WP (target) budgeted cost of work scheduled (BCWS) profile(s) should be based on but does not need to align with the discrete WP (base) BCWS profile(s). The apportioned WP(s) (target) earned performance equals to the overall weighted incremental percent complete of the discrete WP(s) (base).

The use of apportioned EVT and the increased use of discrete EVT should improve project planning and execution on DOE O 413.3B capital asset projects.

References

1. 2022-06-01 ECRSOP; app.A; CAG 2.0 (EVT J)
2. 2022-04-08 DOE G 413.3-24 planning & scheduling (EVT J)
3. 2020-03-12 GAO-20-195G (EVT J)
4. 2015-12-22 GAO-16-89G (Apportioned Effort)
5. 2022-09-12 NDIA PASEG (Apportioned Effort)
6. 2012-01-01 H&A website (EVT J)
7. 2016-10-24 PMI website (EVT J)
8. 2020-08-13 AACEI; toc_79r-13 (EVT J)
9. 2023-11-21 DOE CPP DID V05.01
10. 2023-06-21 DOE O 413.3B Chg 7