Encore Analytics

The Department of Energy's Project Reporting and Assessment System (PARS)

PARS Empower Earned Schedule Analysis, Module 7
PARS User Advanced Training

1

Welcome to the Seventh of eight session of the Department of Energy's Project Reporting and Assessment System advanced user training. This session is approximately 50 minutes in length. In this course the focus will be on the user, which include the contractor managing the project, the federal project director, the DOE program oversight, and DOE headquarters independent project analysis, using the tools in Empower to better look at projects performance data. The analysis and reporting capabilities of PARS provide decisions makers at all levels to best manage these projects over their lifecycle. In this course we will look at how to evaluate and Analysis earned schedule data in the Empower tool. This topic is new to the DOE world and has a short section in the EPASOP.
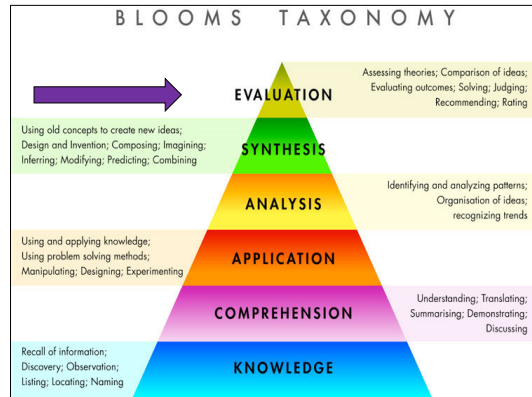
Training Objectives

Encore Analytics

- **Assess which Empower and PARS tools and capabilities to use in analyzing projects.**
- **Apply DOE EVMS and Project Analysis Standard Operation Procedure to projects**
- **Evaluate Projects using appropriate dashboards, views, charts, and reports information**
- Assess data provided to DOE through the use of EVMS metric tests and data quality reports
- **Building advanced pre-filters in Empower**

AT COMPLETION - EARN **8 CEU/PDUs**
- Federal Employees – Will be added to CHRIS
- Contractor Employees – Certificate will be emailed MZW3

BLOOMS TAXONOMY

Using old concepts to create new ideas; Design and Invention; Composing; Imagining; Inferring; Modifying; Predicting; Combining

EVALUATION — Assessing theories; Comparison of ideas; Evaluating outcomes; Solving; Judging; Recommending; Rating

SYNTHESIS

ANALYSIS — Identifying and analyzing patterns; Organisation of ideas; recognizing trends

Using and applying knowledge; Using problem solving methods; Manipulating; Designing; Experimenting

APPLICATION

COMPREHENSION — Understanding; Translating; Summarising; Demonstrating; Discussing

Recall of information; Discovery; Observation; Listing; Locating; Naming

KNOWLEDGE

2

This seventh session will focus on training objective in conducting Earned Schedule Analysis in Empower. We will use the advanced capabilities within Empower to provided Analysis to support Evaluiation capabilities, as outlined in the pyramid to the right.   Earned schedule is another tool to support an analysts evaluation of the a projects ability to complete on time, on budget, and with all scope.

Earned Schedule is in the EPA SOP, but is new to many, so we will start with some basic understanding and move forward with what is provided out of the box in Empower. For the most part, if the data provided has EV data and schedule, we can do a basic analysis of ES. Let's get started…

MZW3   How to provide credit? - Sig

Matthew Z West, 8/25/2020

Why Earned Schedule, EV is not enough?

Encore Analytics

- How many of you ever ran late for meeting and called in told them you were $20 dollars late?
  - As you know, that is how EVM measures schedule performance
  - It is not always intuitive that 'schedule' metrics are also measured in terms of $ not time
- Earned Schedule (ES) uses analytical technique similar to EVM however, it uses the X-axis as time
  - The results are time-based rather than dollar-based – I'm running 20 minutes late
  - It provides an accurate measure of true schedule performance
  - It helps you know what the Estimate Completion Date is based performance data
- ES <u>supplements</u> many indices and other calculations used in EVM

3

Ever heard of the phrase, time is money, well ES attempts to convert money to time. How many of you ever ran late for meeting and called in told them you were $20 dollars late? That does not make sense, however, if you told them you were 20 minutes late, they will understand that. We are taught that SV is a dollar and not time, which is correct in Earned Value Management (EVM). We have learned to make it work, but something is missing.

> EVM measures schedule performance in dollars while ES measures schedule performance in time.
> It is not always intuitive that 'schedule' metrics are also measured in terms of $ not time. I understand that cost side, if we are over running, but is there jeopardy on missing the deliverable. What performance efficiency must I have execute in the future to meet my baseline or forecast dates? In the long run, SV must always go to zero when the project completes and as it gets closer to completion, it does not tell the whole story in terms of performance, but using ES does.

Earned Schedule (ES) uses analytical technique similar to EVM however, it uses the X-axis as Time. Empower has provided a time based x-axis to conduct ES analysis.

The results are time-based rather than dollar-based – I'm running 20 minutes late

It provides an accurate measure of true schedule performance. As we will talk more in the coming slides, we will show why EV SV has failed us as we move closer to completion and how ES can shine in the later stages.

After all would you like to know what the Estimate Completion Date is based performance data? This is a question I hear a lot during program reviews, what is the target completion data, and are we going to hit it?

ES supplements many indices and other calculations used in EVM. Keep in mind, ES is just another tool in your shed of available data, not one tool will answer your question, but it will provide a different perspective and analysis not previously available.

Schedule Weakness?

Encore Analytics

- Most analyst are not schedulers and analysis can be overwhelming
- It also introduces some schedule weakness, such as:
  - Schedules assume a future performance of 1.0
  - Does the current finish date take into effect current schedule performance indicators?
- How 'ahead or behind' schedule are we? You can compare Baseline to Forecast but how can that analysis be done by CA or WP?
- ES attempts to provide predictors that are analogous to those accepted by EVM community, such as:
  - You will notice a (t) to denote it is ES or time based performance indicators
  - SV(t) instead of SV,
  - SPI(t) instead of SPI

4

Most analyst are not schedulers and analysis can be overwhelming by the various scheduling toolset in the market place. Some do not have access to scheduling tools this is also another challenge.

It also introduces some schedule weakness, such as:

Schedules assume a future performance of 1.0. If you do not have schedule performance indicators, or prior performance experience of similar effort, it is hard to plan the future work based on current performance indicators.
Does the current finish date take into effect current schedule performance indicators? Normally this data is not available since SPI and SV do not provide what it took (pace and condition) of the effort. More on that coming up.

How 'ahead or behind' schedule are we? You can compare Baseline to Forecast but how can that analysis be done by CA or WP? It is a challenging task to analyze , you need a scheduler beside you to conduct the necessary filters.

ES attempts to provide predictors that are analogous to those accepted by EVM community, such as:
You will notice a (t) to denote it is ES or time based performance indicators.

This will indicate the data values are 'time' based and not dollar based.

SV(t) instead of SV, now the Variance is measured in 'duration' or periods, more on that later. For DOE government reporting a period is normally one month.

SPI(t) instead of SPI, this value will continue to be an index, however, it does not go to 1 at the completion of the Element.

EVM Weakness?

Encore Analytics

- ES does NOT replace traditional EV – <u>cannot have ES without EV</u>
- EVM has well established indicators such as CV, CPI, TCPI and EAC, however
- They provide <u>Cost</u> Variance, <u>Cost</u> Performance, notice the trend 'Cost'
- At % Complete greater than 65% traditional SPI tends to fail, here's why
  - As BCWP moves to BCWS, SV moves towards $0 -   SV = BCWP - BCWS
  - Similarly SPI moves towards 1 -   SPI = BCWP/BCWS
- Another words, later project stages, traditional SV and SPI are not useful
- Late running project is where ES becomes very useful
- No time-based future performance index to meet Estimate Completion Dates

5

One fallacy that I hear is that ES may not be reliable data. I ask them if they think their EVM data is reliable?   If it is, then I tell then that ES is based on EVM data. It does NOT replace traditional EV – <u>cannot have ES without EV.   All the ES calculations are based on have proper SPA values, and future completion dates.</u>

EVM has well established indicators such as CV, CPI, TCPI and EAC, they work very well in establishing cost indicators and predictors.

However, they provide <u>Cost</u> Variance, <u>Cost</u> Performance, notice the trend 'Cost' not schedule or time based value.

At % Complete greater than 65% traditional SPI tends to fail, here's why
    As BCWP moves to BCWS, SV moves towards $0 -   SV = BCWP – BCWS   All elements finish with SV = 0
    Similarly SPI moves towards 1 -   SPI = BCWP/BCWS All elements finish with SPI = 1.
Another words, later project stages, traditional SV and SPI are not useful for planning other similar efforts, there is not insight into how well or bad the effort finish state was.

Late running project is where ES becomes very useful. Just because a project finish late only tells you have the story, did it start late? How was the pace of the work? More on that soon.

ES can be used in drill down w/Filter analysis just like traditional EVM data. Use the same techniques we used for Variance, Trending and EAC analysis that you learned from prior sessions

No time-based future performance index to meet Estimate Completion Dates

What is lost with tradition SV and SPI?

- Did we do that right? Took longer, shorter than originally planned?
- Did we start late but become for efficient If we finished on time was it because we were more efficient
- If we started late and finished late, but was the work performed on pace?
- What efficiency do we need in order to achieve the forecasted completion?
- Did the team become more efficient over time? They learned how to make the product faster?
- Did the team become less proficient over time, what did we learn?
- What did we learn for next: EMD, Qual, Production

6

At completion, traditional SV and SPI falls short like:

Did we do that right? Took longer, shorter than originally planned?

Did we start late but become for efficient If we finished on time was it because we were more efficient.   This is masked because the Pace is lost at completion, did we become more efficient in time.

If we started late and finished late, but was the work performed on pace?

What efficiency do we need in order to achieve the forecasted completion?

Did the team become more efficient over time? They learned how to make the product faster?

Did the team become less proficient over time, what did we learn?

What did we learn for next effort EMD, Qual, Production

Encore Analytics

- At later stages of the Project/Element, it offers reliable **<u>Condition</u>** and **<u>Pace</u>**
  - **Condition**: is it on time, ahead of schedule or behind schedule
  - **Pace**: Is the pace as planned, faster than planned or slower than planned
- Reliable indicators as the Element approaches completion:
  - SV(t) becomes a more reliable condition metric (**Condition**)
  - SPI(t) become a more realistic efficiency to use (**Pace**)
- At completion date provides:
  - How did we do 'condition' is recorded: Did we finish ahead, behind or on time
  - More importantly, was the work 'performed': on pace, fast, or slow
- To complete Predictors – PDWR, EDWR and IEAC(t)
- SPI(t) can be compared to TSPI – no equivalent schedule analysis from traditional EVM metrics

7

At later stages of the Project/Element, % Complete > 65%, it offers reliable **<u>Condition</u>** and **<u>Pace</u>**

> **Condition**: are we on time, ahead of schedule or behind schedule, if so how much time?
> **Pace**: Is the pace as planned, faster than planned or slower than planned

Reliable indicators as the Element approaches completion:

> SV(t) becomes a more reliable condition metric
> SPI(t) become a more realistic efficiency to use

At completion date provides:

> How did we do 'condition' is recorded: Did we finish ahead, behind or on time
> More importantly, was the work 'performed': on pace, fast, or slow

To complete Predictors – Plan Duration of Work Remaining (PDWR), Estimated Duration of Work Remaining (EDWR) and Independent Estimate at Complete – Time (IEAC(t)) More on these new acronyms shortly.

SPI(t) can be compared to TSPI – no equivalent schedule analysis from traditional EVM metrics

SV vs. SV(t) – Condition: Ahead, Behind, On Time

- SV and SV(t) track together until you begin approaching completion > 65% Complete
- Remember SV is Cost not Time
- SV(t) 'shines' as you approach completion, a critical phase of the project.
- For future planning, we can use these condition metrics as reference for: took "longer" or "short" for similar Element(s) or Project

Condition	SV	SV(t)
1	On "Time"	On Time
> 0	Ahead	Ahead
< 0	Behind	Behind
Approaching Completion	Moving towards $0	Reliable Condition Tracking
At Project Completion	$0	Condition Tracked

Let's table about CONDITION: This table sums up SV and SV(t) values. In both cases, values of zero indicate an on track condition, while greater than 0 and less than 0 are ahead and behind respectively. But as the project nears completion, SV will automatically trend toward 0, while SV(t) continues to measure the ahead/behind duration.

SV and SV(t) track together until you begin approaching completion > 65% Complete Remember SV is Cost not Time

SV(t) 'shines' as you approach completion, a critical phase of the project.

For future planning, we can use these condition metrics "condition tracked" as reference for: took "longer" or "short" for similar Element(s) or Project

SPI vs. SPI(t) – <u>Pace</u>: Slow, Fast or On Pace

- SPI and SPI(t) track together until you begin approaching completion > 60% Complete
- SPI(t) 'shines' as you approach completion, a critical phase of the project.
- For future planning, we can use these condition metrics as reference for: took "faster" or "slower" to complete for a similar Element(s) or Project

Pace	SPI	SPI$_t$
1	On Pace	On Pace
> 1	Fast Pace	Fast Pace
< 1	Slow Pace	Slow Pace
Approaching Completion	Moving towards 1	Reliable Pace Tracking
At Project Completion	1	Pace Tracked

The Pace can be sums up if the effort is/was on pace (as planned) or on a fast track to complete in a shorter than originally planned or taking longer that originally planned.

As we mentioned earlier, not one metrics give you all the answer, in this example, if the pace is fast was it because:
- More experienced resources and maybe more efficient, perhaps the labor rate variance may show light on this
- More resources where put in place, then the Usage variance will reflect this
- Team learn how to build the 'mouse trap faster and better' as they progressed through the development cycle

SPI and SPI(t) track together until you begin approaching completion > 65% Complete

SPI(t) 'shines' as you approach completion, a critical phase of the project.

At completion, we can now answer some of the basic questions for future design, development phases. The pace was tracked.

All the conditions outcomes, total of 9 outcomes when using SV(t) and SPI(t). Courtesy of Humphreys & Associates for providing this one picture is worth a thousand words graph.

Animated slide
Here is a look at all of the various ways work can be performed from a schedule perspective…faster, slower or on pace. And ahead, behind and on schedule. In each case, SPI(t) and SV(t) tell the same story.

(click 1)
Keep in mind, these are "finish" outcomes
And in all 9 conditions, SPI would be 1.0 and SV would be 0.

Checks on Learning – ES Overview

1. What does Earned Schedule have to offer?
   A. Reliable efficiency and variance after 65% complete
   B. Time based predictors
   C. Condition and pace at or near completion
   D. SPI(t) to TSPI(t) comparisons
   E. All the above are correct

2. According to our presentation, what are some of the weakness of EVM?
   A. After 65% Complete the SPI becomes less reliable for analysis
   B. Sometimes EVM data is unreliable for analysis
   C. Traditional EVM only deals with Cost and not time based
   D. No predictor for estimate at completion date
   E. Answer C and D are correct
   F. Answer A, C and D are correct

3. SPI(t) determines what?
   A. If element is ahead or behind
   B. The condition of the tasks
   C. The pace of the tasks
   D. All are correct

4. What is the condition and pace of the image to the right?
   A. Late but started late.
   B. Fast Pace and Early.
   C. On pace and late
   D. Fast pace and Late
   E. Answers A and D are all correct

SPI_t = 1.3
SV_t = -9 days

11

Encore Analytics

- ES Metrics
    - ES – Earned Schedule is analogous with BCWP or EV
    - AT – Actual Time is for period count from start to time now
    - PD – Planned Duration is analogous with time-phased BCWS for all periods
    - ED – Estimate Duration is analogous with time-phased ETC for all periods
- ES indicators
    - SV(t) is analogous with SV $
    - SPI(t) is analogous with SPI
- ES Predictors
    - IEAC(t) analogous with IEAC, predicts planned duration based on SPI(t)
    - PDWR – Planned Duration Work Remaining - from ES to planned completion, is analogous to BCWR
    - EDWR – Estimate Duration work remaining from AT to forecast completion date, analogous to ETC

12

By now you will notice that the trending, analysis and metrics are similar to the traditional EVM. With a slightly different perspective, instead of Dollar we are using the measure of time.

ES Metrics

ES – Earned Schedule is analogous with BCWP or EV

AT – Actual Time is for period count from start to time now

PD – Planned Duration is analogous with time-phased BCWS for all periods

ED – Estimate Duration is analogous with time-phased ETC for all periods

ES indicators

SV(t) is analogous with SV $

SPI(t) is analogous with SPI

ES Predictors

IEAC(t) analogous with IEAC, predicts planned duration based on SPI(t)

PDWR – Planned Duration Work Remaining - from ES to planned completion, is analogous to BCWR

EDWR – Estimate Duration work remaining from AT to forecast completion date, analogous to ETC

DOE Earned Schedule Dashboard D-008

- S-032 DOE Earned Schedule View
  - Earned Schedule Metrics – EA, PD, ES and AT
  - Earned Schedule Indicators – SV(t), SPI (t) and TSPI(t)
  - Earned Schedule Predictors – IEAC(t), PDWR, EDWR
  - % Complete and %Spent, Forecast and Baseline Date for reference
- Earned Schedule Chart – two charts available
  - Provides ES trending over time for any element/project
  - Metrics Chart - PD, ES, ED, IEAC(t) and SV(t)
  - Indicator (index) Chart – CEI, SPI(t), TSPI(t) to ED or PD
- Earned Schedule Report
  - Tabular performance data for the last twelve (12) periods
  - ES data value mixed with traditional EVM values

13

The DOE Earned Schedule Dashboard has been provided as your initial launching point to conduct Earned Schedule Analysis.

Let's start with the Earned Schedule View, it is the top part of the Tri Pane of Empower. It is rich with various types of Earned Schedule data, from metrics, to indicators to predictors, some dollars, others in time and indices. We will talk about each of the panes in the coming slides.

On the bottom left you will see charts that plot out ES Metrics and Indicators. We will address them in more detail, but a key point is this data is available at any level of the structure all the way to the top.

On the bottom right is the twelve Period Summary Chart.   It is design similar to the six period summary, except it has ES data such as Metrics, Indicators and Predictors for the last twelve periods.   It is mixed with mostly ES data calculations but some traditional cost metrics are included for comparisons purposes.
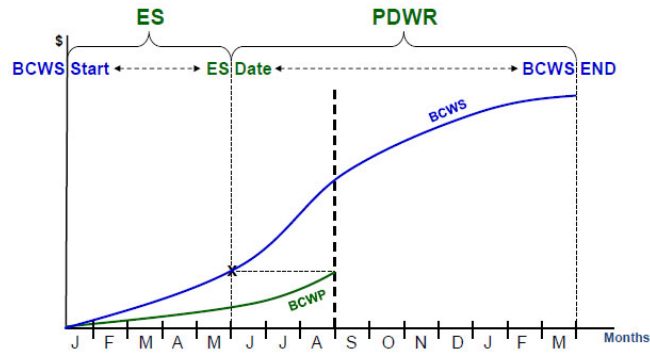
ES & PDWR

TBD
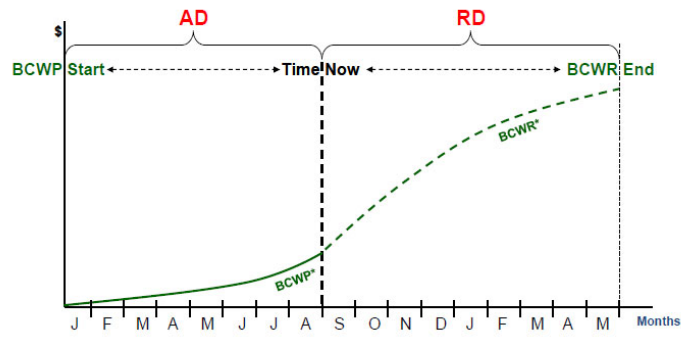
AD & RD

DOE Earned Schedule Dashboard
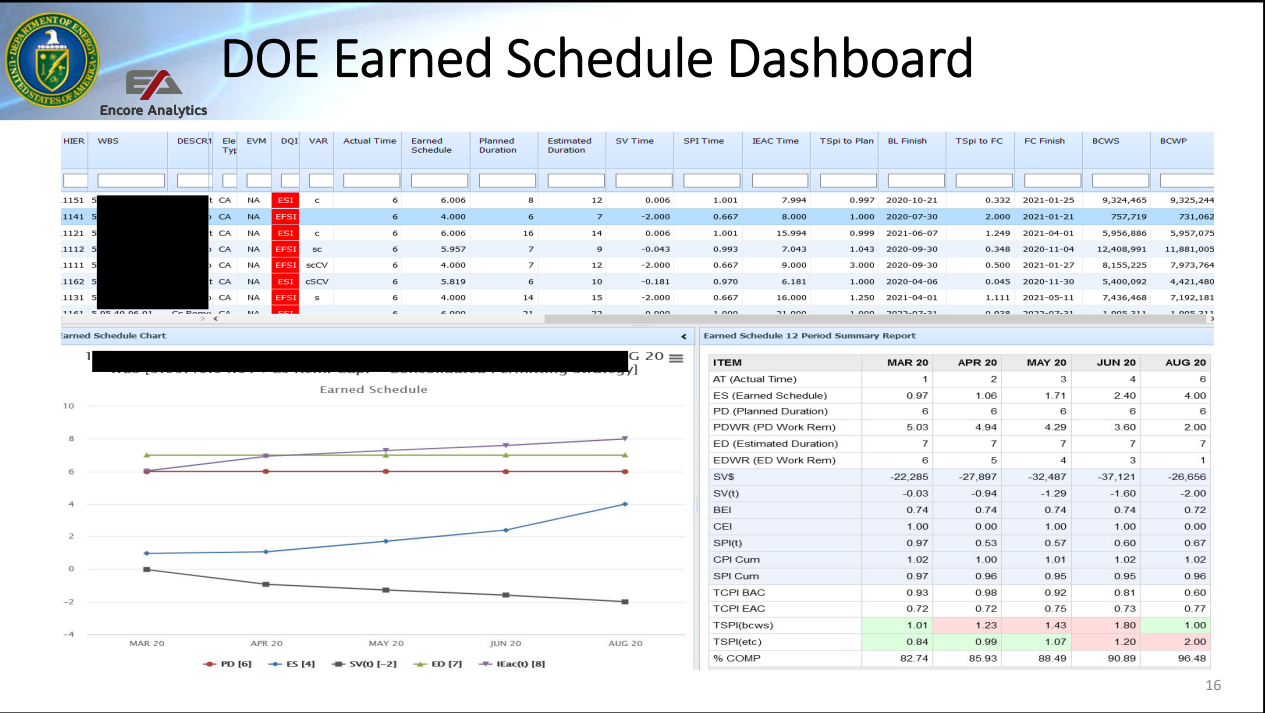
Screen shot of the DOE Earned Schedule Dashboard in the tri pane view. We will cover each in greater detail, but shown is the starting point for ES analysis. Let's look at how some the calculations and fields in greater detail.

ES View - Metric & Indicator Field Definitions

Encore Analytics

- AT - Actual Time – Periods up to time now
- ES - Earned Schedule –duration should have earned our current BCWP
- PD - Planned Duration – Number of Periods from first BCWS to last BCWS
- ED - Estimate Duration – Number of Periods from first ACWP/ETC to Last ETC
- SV(t) - SV Time – Number of periods of time ahead / behind plan
  SV(t) = ES – AT.   Any negative value is considered 'behind' schedule (condition)
- SPI(t) - SPI Time – Measured in time the schedule efficiency SPI(t) = ES/AT. A indices below 1 is consider 'slow' pace.

For DOE Government Reporting
A Period is one Month

Actual Time	Earned Schedule	Planned Duration	Estimated Duration	SV Time	SPI Time	IEAC Time
6	4.000	7	12	-2.000	0.667	9.000
6	4.000	7	15	-2.000	0.667	9.000
6	4.000	7	10	-2.000	0.667	9.000
6	4.000	6	7	-2.000	0.667	8.000

17

Displayed are the basic values generated from Empower for the ES metric and indicators.

AT - Actual Time – Periods in Empower up to now
ES - Earned Schedule –duration should have earned our current BCWP
PD - Planned Duration – Number of Periods from first BCWS to last BCWS
ED - Estimate Duration – Number of Periods from first ACWP/ETC to Last ETC
SV(t) - SV Time – Number of periods of time ahead / behind plan
SV(t) = ES – AT.   Any negative value is
considered 'behind' schedule (condition)
SPI(t) - SPI Time – Measured in time the
 schedule efficiency SPI(t) = ES/AT. Any
below 1 is consider 'slow' pace.

One of the question I get asked is how is the duration or periods calculated in Empower. The short answer is you are providing time-phased data and 'periods' in Empower, so we count the calendar period as "duration" or monthly duration value. For example if you have 6 for the Actual Time, that would mean that Empower sees that six 'periods' have been imported into Empower.

Empower calculates the Periods or Duration based on:

Duration is the count of Periods – in this case month(s) you can verify this by downloading Periods for the respective contract

Actual Time is count of periods, from First BCWS to Time Now

Planned Duration total count of periods from First BCWS date to Last BCWS date in the case showing, from March to September, 7 periods

Estimate Duration total count of Periods from the First ACWP/ETC date to the Last ACWP/ETC date, in the case showing, March to December, 10 periods

With traditional EV, there is no schedule counterpart to TSPI. But there is in ES, TSPI is the To-complete Schedule Performance Index. It is a measure of the schedule efficiency needed in order to achieve the current forecasted or planned completion dates. These fields are 'predictors' of future efficiency or remaining work and IEAC durations.

TSPI to Plan – Measure of schedule efficiency needed in order to achieve the current plan/baseline completion date
PDWR - Plan Dur Work Remaining – Periods from ES Date to Last BCWS Date, again analogous to BCWR (time)
TSPI to FC – Measure of schedule efficiency needed in order to achieve the Forecast completion date
EDWR - FC Dur Remaining – Periods from Actual Time Date to Last ACWP/ETC date, Est Duration Work Remaining, again analogous to ETC (time)
BL Finish – Baseline Finish Date from the schedule
FC Finish – Forecast Finish Date from the schedule
IEAC Time – Planned Duration based SPI(t) efficiency = AT+ PDWR/SPI(t)   Another words

This chart plots out the ES duration based metrics as a trending chart. On the left, is the duration periods, any negative value for ES or SV(t) will be 'behind' schedule condition. As with most charts in Empower, you can click the Legend to hide non pertinent items. When doing the analysis, you can see that the EOC Subcontract is driving the CV for this element.

What to look for in this chart:
Chart plots Duration (Periods) based value over time
Look for ES below the '0' line, will reflect behind schedule this will reflect all the way to completion.

Look for IEAC (t) having a larger value than PD. This will mean that the baseline completion will take longer than originally planned duration

Changes in PDWR may reflect baseline volatility, look at other reports showing volatility data.

SV(t) – Schedule Variance in <u>duration</u>. Below zero is behind schedule and not improving. An indication that corrective actions plans are not working, need further

investigations.

ES Chart – Duration Work Remaining

- PDWR – Plan Duration Work remaining trending to the Baseline Date
- EDWR – Estimate Duration Work Remaining to the Forecast Date
- Look for divergence from PDWR and IEAC(t) lines
- Indicates that it may take longer to complete the budgeted effort
- Look for upward trending IEAC(t), may need to look at missed tasks (BEI/CEI) data.
- Look for EDWR volatility, high and low peaks
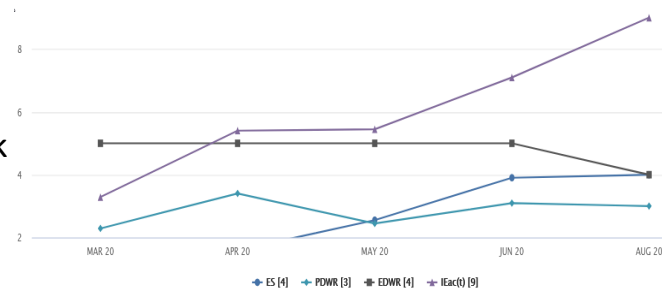
21

Chart for Duration Work Remaining, to either the BL or FC completion dates.

PDWR – Plan Duration Work remaining trending to the Baseline Date

EDWR – Estimate Duration Work Remaining to the Forecast Date

The below are cause for further investigation

   Look for divergence from PDWR and IEAC(t) lines - Indicates that it may take longer to complete the budgeted effort

   Look for upward trending IEAC(t), may need to look at missed tasks (BEI/CEI) data.

   Look for EDWR volatility, high and low peaks

ES Chart shows the indicators for field in index values. Again we are comparing how CPI and TCPI are analyzed, in this case SPI to TSPI. We plot TSPI to the Estimate and Baseline dates.

SPI(t) behaves much like its counterpart SPI in EVM. It is the current efficiency for selected element.

If SPI(t) is diverging from TSPI, that would be an increase efficiency will be needed to achieve the completion date. Need to investigate why the divergence and if it is realistic that you can correct to complete by the desired date.

ES 12 Period Summary Report

- Tabular report of ES that contains metrics, indicators and predictors
- Metrics (top section) are Durations
- Indicators mix units (time, cost and index)
- Predictors (lower section) mix units (time, cost, duration) and % schedule
- Several studies have shown that a TSPI
  - < 1.0 good chance of hitting the date (Green)
  - 1.0 to 1.1 is a 'maybe' hit the date
  - > 1.1 low confidence level of hitting the date (red)
- % Schedule – how much work should be currently completed to the Baseline. Use to cross reference the ES numbers.

-009 Earned Schedule 12 Period Summary Report

ITEM	MAR 20	APR 20	MAY 20
AT (Actual Time)	1	2	3
ES (Earned Schedule)	0.98	1.98	1.59
PD (Planned Duration)	3	3	14
PDWR (PD Work Rem)	2.02	1.02	12.41
ED (Estimated Duration)	5	5	14
EDWR (ED Work Rem)	4	3	11
SV$	-155,322	-162,615	-48,858
SV(t)	-0.02	-0.02	-1.41
BEI	0.99	1.00	0.99
CEI	1.00	1.00	1.00
SPI(t)	0.98	0.99	0.53
CPI Cum	1.09	1.09	1.10
SPI Cum	0.98	0.98	0.99
TCPI BAC	0.32	0.24	0.77
TCPI EAC	0.86	0.43	0.85
TSPI(bcws)	1.01	1.02	1.13
TSPI(etc)	0.51	0.34	1.13
IEAC(t)	3.02	3.02	15.41
% Schedule	98.58	99.85	77.15

23

This reports should look familiar to you, it looks very much the same style as the six period summary reports you have seen in other sessions.

Tabular report of ES that contains metrics, indicators and predictors

Metrics (top section) are Durations

Indicators (mid section) mix units (time, cost and index)

Predictors (lower section) mix units (time, cost, duration and %) values
Several studies conducted by Walt Lipze have shown that a project with the following TSPI show the following results

    < 1.0 good chance of hitting the date (Green)
    1.0 to 1.1 is a 'maybe' hit the date
  ➢ 1.1 low confidence level of hitting the date (red)

% Schedule is how much work should have been complete to the baseline. It can be used to crosscheck the ES value. For example if you have PD of 10 and you are 50%

schedule, your ES should be 5. Anything less than that would indicate behind schedule.

Checks on Learning – ES Fields

Encore Analytics

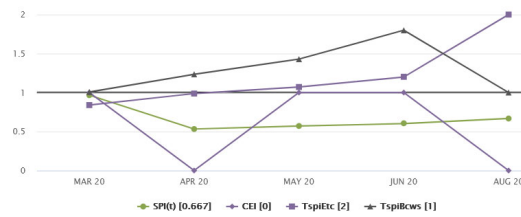1. In the ES View to the right, what statement is true?
   - A. Shows 2 period ahead of schedule
   - B. Shows 2 periods behind schedule
   - C. Pace is slower than originally planned
   - D. Work planned is taking longer to complete
   - E. All answers are correct

	Actual Time	Earned Schedule	Planned Duration	Estimated Duration	SV Time	SPI Time	IEAC Time
	6	4.000	7	12	-2.000	0.667	9.000
	6	4.000	7	15	-2.000	0.667	9.000
	6	4.000	7	10	-2.000	0.667	9.000
	6	4.000	6	7	-2.000	0.667	8.000

2. What does the report below tell you?
   - A. Cost is holding steady, schedule has deteriorated
   - B. Recent schedule performance has worsened
   - C. Too volatile to tell
   - D. Difficult to achieve EAC and Completion date

SPI(t)	0.98	0.99	0.53
CPI Cum	1.09	1.09	1.10
SPI Cum	0.98	0.98	0.99
TCPI BAC	0.32	0.24	0.77
TCPI EAC	0.86	0.43	0.85
TSPI(bcws)	1.01	1.02	1.13
TSPI(etc)	0.51	0.34	1.13
IEAC(t)	3.02	3.02	15.41
% Schedule	98.58	99.85	77.15

Chart legend: SPI(t) [0.667], CEI [0], TspiEtc [2], TspiBcws [1]
(x-axis: MAR 20, APR 20, MAY 20, JUN 20, AUG 20)

3. The ES View above shows that ?
   - A. Divergence from TSPI and SPI
   - B. Easier to achieve the Baseline than the Forecast completion date
   - C. Current execution index show 100% completion
   - D. Easier to achieve the Forecast than the Baseline completion date
   - E. Answer A and B are correct
   - F. Answer C and D are correct

Encore Analytics

- Filter for % Complete > 65 – prior to that SPI $\approx$ SPI(t)

- Higher levels may mask underling issues, use CA level

- Similar methodology for analysis as traditional EVM metrics
    - Drill down capability with
    - SV(t) – look for trending towards completion
    - SPI(t) – look for divergence from tradition

- Check if SPI(t) $\approx$ TSPI, if it is not, investigate why
    - Empower will highlight in red in the ES Report

- IEAC (t) – check to see Duration

25

By now you will notice that the trending, analysis and metrics are similar to the traditional EVM. With a slightly different perspective, instead of Dollar we are using the measure of time.

Filter for % Complete > 65 – prior to that SPI $\approx$ SPI(t) In certain screen shots I have 60%, for purposes of having more data to show in this presentation

Higher levels may mask underling issues, use CA level, you may filter to Level 4 -6, just above the CA or at the CA level.

Similar methodology for analysis as traditional EVM metrics
        SV(t) – look for trending towards completion
        SPI(t) – look for divergence from tradition

Check if SPI(t) $\approx$ TSPI, if it is not, investigate why
        Empower will highlight in red in the ES Report

IEAC (t) – check to see Duration

Earned Schedule – Variance Analysis

Encore Analytics

LVL	% Complete	Element Type	Actual Time	Earned Schedule	Planned Duration	Estimated Duration	SV Time	SPI Time	IEAC Time	TSpi to Plan	BL Finish	Plan Dur Remaining	Tspi to FC	FC Dur Remaining	FC Finish
5	>60														
5	79.50	CA	6	4.000	14	15	-2.000	0.667	16.000	1.250	2021-04-01	10.000	1.111	9.000	2021-05-11
5	96.31	CA	6	6.006	16	14	0.006	1.001	15.994	0.999	2021-06-07	9.994	1.249	8.000	2021-04-01
5	91.95	CA	6	4.000	7	12	-2.000	0.667	9.000	3.000	2020-09-30	3.000	0.500	6.000	2021-01-27
5	96.48	CA	6	4.000	6	7	-2.000	0.667	8.000	1.000	2020-07-30	2.000	2.000	1.000	2021-01-21

- I used 60% so that I can analyze more data, DOE uses 65%
- In the view you will notice the highlighted in red box, Duration of planned and estimate values in comparison to IEAC Time, duration adjusted for SPI(t)
- It will show an 'over run' in time or later finish.
- The BL Finish and FC Finish dates are provided to show current completion dates

26

The ES View was used to do this analysis. For purposes of analysis and show more, I used 60%, but 65% is recommended in literature and was selected as a reasonable point at DOE.
I also drilled down or filter to level 5 – Control Account level in this case

In the view you will notice the red boxes, Duration of planned and estimate values in comparison to IEAC Time, duration adjusted for SPI(t)
It will show an 'over run' in time or later finish.
The BL Finish and FC Finish dates are provided to show current completion dates

ES – Time to Complete Analysis

Encore Analytics

LVL	% Complete	Element Type	Actual Time	Earned Schedule	Planned Duration	Estimated Duration	SV Time	SPI Time	IEAC Time	TSpi to Plan	BL Finish	Plan Dur Remaining	Tspi to FC	FC Dur Remaining	FC Finish
5	>60														
5	79.50	CA	6	4.000	14	15	-2.000	0.667	16.000	1.250	2021-04-01	10.000	1.111	9.000	2021-05-11
5	96.31	CA	6	6.006	16	14	0.006	1.001	15.994	0.999	2021-06-07	9.994	1.249	8.000	2021-04-01
5	91.95	CA	6	4.000	7	12	-2.000	0.667	9.000	3.000	2020-09-30	3.000	0.500	6.000	2021-01-27
5	96.48	CA	6	4.000	6	7	-2.000	0.667	8.000	1.000	2020-07-30	2.000	2.000	1.000	2021-01-21

- Two items to look for:
  - Current pace of the element, >1.0 indicates a slower pace
  - Comparison of the SPI(t) and TSPI(t) if not close, or TSPI is higher, ask why?
- It will indicate that a longer time will be required to complete the scope
- Compare to the TSPI Planned and Forecasted dates

27

Two items to look for:

Current pace of the element, >1.0 indicates a slower pace

Comparison of the SPI(t) and TSPI(t) if not close, or TSPI is higher, ask why?

It will indicate that a longer time will be required to complete the scope

Compare to the TSPI Planned and Forecasted dates

ES – Trending Analysis

- Trending analysis of the SPI(t) to TSPI(t)
- Similar to CPI to TCPI, any value greater than .10 should be investigated
- Chart shows 4 months ago there was a divergence, why?
- The trending information show divergence is continuing
- Greater level of efficiency is required to meet the Estimate completion date.
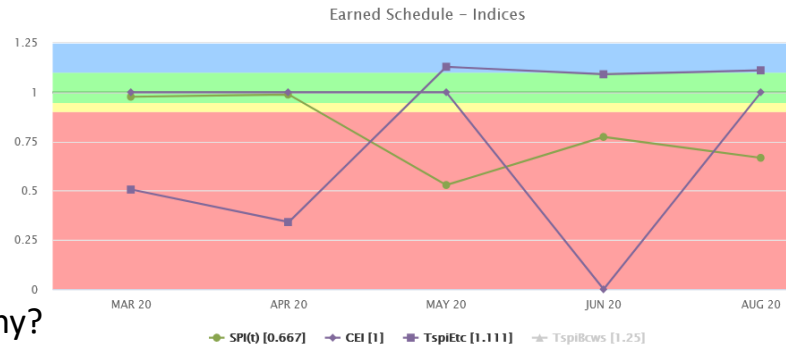
28

Trending analysis of the SPI(t) to TSPI(t)
Similar to CPI to TCPI, any value greater than ABS difference of .10 should be investigated

Chart show that 4 months ago there was a divergence, why?

The trending information show divergence is continuing

Greater level of efficiency is required to meet the Estimate completion date

Again – this provides a place to have a discussion internal to the project or by the federal team with the contractor.

SPI(t) vs TSPI – At Complete Analysis

- In the same way analysis of the CPI to TCPI, SPI(t) can compared to TSPI
- Empower provides TSPI to last BCWS and ETC completion dates
- Notice after the second period, there was additional budget/scope added
- Why is the TSPI, future efficiency significantly different than past efficiency…SPI(t)
- Past SPI(t) indicates that TSPI will be difficult to achieve, expect further schedule slips in the future.

AT (Actual Time)	1	2	3	4	6
ES (Earned Schedule)	0.98	1.98	1.59	3.09	4.00
PD (Planned Duration)	3	3	14	14	14
PDWR (PD Work Rem)	2.02	1.02	12.41	10.91	10.00
ED (Estimated Duration)	5	5	14	14	15
EDWR (ED Work Rem)	4	3	11	10	9
SV$	-155,322	-162,615	-48,858	-59,302	-244,286
SV(t)	-0.02	-0.02	-1.41	-0.91	-2.00
BEI	0.99	1.00	0.99	0.98	0.99
CEI	1.00	1.00	1.00	0.00	1.00
SPI(t)	0.98	0.99	0.53	0.77	0.67
CPI Cum	1.09	1.09	1.10	1.11	1.11
SPI Cum	0.98	0.98	0.99	0.99	0.97
TCPI BAC	0.32	0.24	0.77	0.75	0.72
TCPI EAC	0.86	0.43	0.85	0.87	0.97
TSPI(bcws)	1.01	1.02	1.13	1.09	1.25
TSPI(etc)	0.51	0.34	1.13	1.09	1.11
% COMP	96.36	97.52	76.61	77.22	79.50

29

Looking at the 12 period ES summary report,

In the same way CPI is compared to TCPI, SPI(t) can be compared to TSPI. This is because SPI(t) is the schedule efficiency we have experienced so far, and TSPI is the schedule efficiency we will need to maintain in order to make or currently forecasted or baseline completion date.

And if the future efficiency is significantly different than the past efficiency…why?

Empower provides TSPI to last BCWS and ETC completion dates

Notice after the second period, there was additional budget/scope added

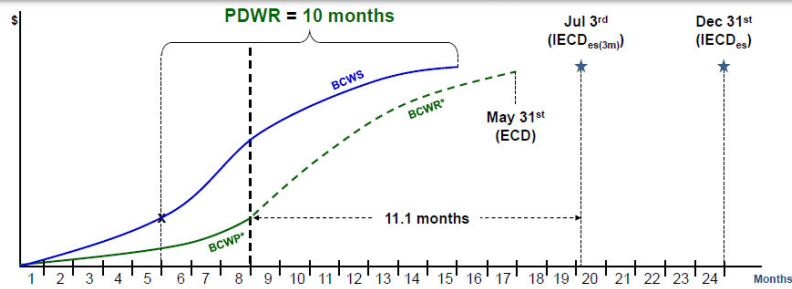Why is the TSPI, future efficiency significantly different than past efficiency…SPI(t)

Past SPI(t) indicates that TSPI will be difficult to achieve, expect further schedule slips in the future.

iECD

Checks on Learning – ES Analysis

Encore Analytics

1. What can you tell me about the tabular report to the right?
   - A. Pace was faster than planned
   - B. Cost variance at complete showed finished 1 period ahead
   - C. SV$ and SPI as predictive when to 0 and 1 respectively
   - D. Answer A, B and C are correct
   - E. Answer B and C are correct

2. In looking at the chart to the right what can you tell me about Cost and Earned Schedule metrics?
   - A. SV(t) provided reliable variance after 100% Complete
   - B. SPI is 1.0 at completion
   - C. SPI(t) provides the pace at completion
   - D. SV goes to $0
   - E. Answer B and D are correct
   - F. All answers are correct

3. What can you tell me about 5.05.40.03.01.06 in the ES view below?
   - A. Need to increase Pace to make the 2020-12-10
   - B. SV(t) shows a behind condition of 2 months
   - C. ES and Planned duration is the total Duration for element
   - D. Answers A and B are correct

SV$	0	0	0	0	0
SV(t)	3.00	2.00	1.00	2.00	1.00
BEI	1.00	1.00	1.00	1.00	1.00
CEI	1.00	1.00	1.00	1.00	1.00
SPI(t)	4.00	2.00	1.33	1.50	1.17
CPI Cum	0.72	0.63	0.56	0.50	0.46
SPI Cum	1.00	1.00	1.00	1.00	1.00
TCPI BAC	0.00	0.00	0.00	0.00	0.00
TCPI EAC	1.00	1.00	1.00	0.00	0.00
TSPI(bcws)	1.00	1.00	1.00	1.00	1.00
TSPI(etc)	1.00	1.00	1.00	-1.00	1.00
IEAC(t)	-2.00	0.00	2.00	2.00	5.00
% Schedule	100.00	100.00	100.00	100.00	100.00

WBS		% Complete	Element Type	Actual Time	Earned Schedule	Planned Duration	Estimated Duration	SV Time	SPI Time	IEAC Time	TSpi to Plan	BL Finish	Plan Dur Remaining	Tspi to FC	FC Dur Remaining	FC Finish
5.05.40.05.02.07	IF	46.85	WP	6	4.000	7	12	-2.000	0.667	9.000	3.000	2020-09-30	3.000	0.500	6.000	2021-01-25
5.05.40.02.02.07	IF	44.43	WP	6	4.000	7	9	-2.000	0.667	9.000	3.000	2020-09-30	3.000	1.000	3.000	2020-11-09
5.05.40.03.01.06	IF	42.77	WP	6	4.000	7	10	-2.000	0.667	9.000	3.000	2020-09-30	3.000	0.750	4.000	2020-12-10

31

TBD – consider updating with latest from Yancy Qualls, AUG-23 (NDIA IPMD)