PGCS Webinar: Earned Schedule at 20 Years--A Recap [1]

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Abstract

On March 8, 2023, the Project Governance and Control Symposium (Australia) hosted a Webinar to mark the 20th Anniversary of Earned Schedule.

It was in 2003 that Walt Lipke published "Schedule Is Different" (*Measurable News*, March & Summer). It sparked two decades of research, development, and implementation.

The Webinar brought together eight experts on Earned Schedule. Over a period of four hours in two separate showings, the experts covered a broad diversity of topics related to Earned Schedule.

Some focused on the history of Earned Schedule. Others concentrated on its practice, showing how ES is being used to control both traditional and Agile projects. Still others captured the results of research efforts, both academic and informal.

What emerged was a picture of a vibrant, growing community of use and support for Earned Schedule.

Here is a recap of the event.

1 Walt Lipke - Earned Schedule, 20 years of Innovation

Walt acknowledged the global contribution to the development and furtherance of Earned Schedule over the past 20 years.

He followed with a brief history of how “thinking different” led him to Earned Schedule.

- At the start: successful (and unsuccessful) application of EVM
- Difficulty applying Statistical Quality Control to projects—lack of appropriate data
- Shortfalls in the use of EVM’s SPI
- Functions didn’t fit EVM’s “smooth performance curves” [PV and EV]
- But, the curves could be viewed as a collection of discrete points

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- That is, a series of accumulated data—the sums of Planned Value and Earned Value
- A key insight: Earned Value could be mapped to Planned Value to determine the amount of Planned Duration that was earned
- Big question: what to do when the duration earned did not align exactly with a period end
- Trigonometry to the rescue: proof that cost values are proportional to time values
- Deduction of the ES formula: ES = C[omplete] + I[nterpolation], where C equals the periods in which EV >= PV_C and I= $(EV-PV_C)/(PV_{C+1}-PV_C)$

Walt confirmed the theory with empirical studies. Moving forward, he "built on the new, rather than fighting the old".

Walt then gave an overview of Earned Schedule's use.

There are performance indicators and outcome forecasts. There are metrics for project recovery and measurements of schedule adherence. There's statistical analysis of past performance and estimates of future impacts.

The metrics can be used to manage the current schedule and plan future schedules. As time goes on, you can build an archive of results. You can use them to improve your schedule execution and planning.

Walt noted that there are resources available for learning and applying Earned Schedule. They include study guides, videos, and tools.

Walt's expectation is that, with greater awareness, application of Earned Schedule will grow.

Final thoughts.

Advanced ES Practices, such as schedule adherence and recovery analysis, will be adopted increasingly. He warned against segregating cost, schedule, and technical performance. And, he noted that control systems outside of EVM are already moving in that direction, but in doing so, they end up creating EVM-like systems.

By contrast, Walt sees EVM plus Earned Schedule continuing to power project control.
Kym Henderson Validating Earned Schedule, Research and Studies

2 Kym Henderson - Validating Earned Schedule, Research and Studies

Kym stated that he first became aware of ES through the *Measurable News*. He read Walt Lipke's 2003 article, "Schedule Is Different", and noticed that there was information missing. (Later, a corrected version was published.)

Kym contacted Walt, requesting the missing pieces. That led to an offer to test the theory on his project archive. Kym went on to publish early confirmation of the theory. While doing so, he criticized existing measures as "algebraically flawed". That, he speculated, might have inspired early debate on ES.

Despite the debate (or, perhaps, because of it), adoption of ES was quick: in 2005, PMI-CPM identified ES as an emerging practice. Since then, ES has been featured in the following:

- a PMI EVM Practice Standard
- an NDIA-IPMD Guide
- an ISO EVM Standard
- an Australian National Standard
- an ISO Implementation Guide

Earned Schedule is used in government programs, studied by academics, supported by tools, translated into multiple languages, and made available for use and distribution without charge.

Over time, it seems that the debate on ES credibility has shifted to a debate on whether it is an "add on" to EVM or simply part of EVM.

Why has Earned Schedule been successful? Kym's view is that firs, and foremost, it works!

- It requires no additional data collection beyond Planned Value and Earned Value.
- It tells the likely finish date for a project.
- It can be used at different skill levels. It offers simple metrics for past performance and likely future outcome and advanced metrics for project recovery, schedule adherence, and statistical analysis.
- ES still ties back to EVM basics, closely aligning with familiar EVM terminology.
- Finally, ES enjoys empirical validation, both by practitioners and academics.

Kym concluded by commenting on Walt Lipke.

He highlighted Walt's commitment to placing ES in the public domain, rather than making it proprietary.

Kym believes that ES has not been oversold, as has happened with other techniques. It has relied on control-professionals to make their own decisions on adoption. And, it's been responsive to their comments and critiques.

It was Walt's "brilliant insight" into the relation between PV, EV, and time that has powered ES.

To Kym, it's been a "wild ride" that has benefited him personally. He's proud of his role in ES and its achievements.

3 Keith Heitzman (NASA Contractor) – Interviewed by Pat Weaver

Keith has a 30-year career in project management and control. He has broad experience on large-scale projects and programs. In his current role at the National Aeronautics and Space Administration (NASA,) he is the lead scheduler on the Artemis project.

The Artemis project is well-known, given its recent successful launch. A brief video gave an overview of the project. Its immediate mission is to again set foot on the Moon. Its ultimate goal is Mars.

The Artemis rocket is the only one currently capable of sending people into space. The rocket generates 39 million newtons of thrust.

There are six variations of the Artemis rocket. Planning is underway for all the variants. The size of the planning effort is formidable: 150K activities at the summary level! The plan is broken up by components.

A second video explained the mission further. It was summed up by a phrase that echoes Apollo 11:
"We came in peace. We return for all humanity."

Keith then described his role as lead scheduler for the Space Launch System (SLS). He oversaw the summary level schedule. Keith noted that the schedule did not include contractor details.

Keith's company provides over 200 controls specialists to NASA. In his role, Keith brought to bear his experience in large construction projects. Through one of those projects, he had contact with SpaceX. Helping SpaceX plan the testing of their rocket led to his work for NASA.

Keith then addressed Earned Schedule's fit into the overall controls paradigm on Artemis.

The prime contractor on the Critical Path reported the BCWS and BCWP in labour hours, not dollars. The numbers did not match the contracted schedule.

Keith's team tracked ES week by week. They used ES predictive metrics. And, they fed the ES metrics into Monte Carlo analysis for comparative estimates. They found the ES numbers to be highly accurate.

Keith noted the difference between accounting and project control/engineering. It's the difference between an historian and a fortune teller. One lives in the past, the other in the future.

Keith finds the math behind ES simple, and it yields good information. He sees his current use of ES as a test bed for other projects. It offers good practice and is supported by tools and techniques.

For the future, Keith sees a need to move beyond the hard skills of scheduling to the soft skills of working with teams and communicating results.

4 Robert Van De Velde - Act Fast, Think Fast: Agile Schedule Performance

Robert introduced himself:

- ES user since 2007
- Agile+ES user since 2014
- Blogs at EarnedScheduleExchange
- Videos at EarnedScheduleAcademy
- Products at ProjectFlightDeck

The problem: Agile practitioners feel caught in a dilemma: Act Fast OR Think Slow.

On one hand, Agile's highest priority is to satisfy the customer through early delivery.

On the other hand, projects are limited by scarce resources and time constraints. Decision-making must carefully weigh performance on costs and timeline.

How do you get both reasoned tactics and fast pace of delivery? Combine Agile and Earned Schedule.

It starts with schedule performance. It's the efficiency of value delivery. It tells you whether the volume of delivery meets the plan, and whether that puts you where you should be on the project timeline.

The volume of delivery needs a unit of measure. For Agile, Points are the units. They are relative measures. What's needed, instead, are cardinal measurements of value.

Planned Value and Earned Value are such measurements. Performance, then, is value earned vs value that should have been earned. If value is then linked to time, there's a way to measure schedule performance. And, that's exactly what Earned Schedule does.

An example illustrated how Earned Schedule is calculated. Put simply, count the number of periods in which the amount of Earned Value is greater than or equal to the amount of Planned Value. If there's a partial period, add in the fractional amount.

From the amount of Earned Schedule, calculate the performance rate and estimated duration. With the metrics, you can manage schedule performance. A second example showed how.

Set the baseline. It's the estimated pace of value delivery. Variances from the baseline naturally occur. Use thresholds to quickly identify when a variance requires action. Thresholds of +/-10% are commonly used, but it's better to use allowances for uncertainty and risk. A threshold breach is a call to action.

The ES metrics fit into Sprint Planning. There, past performance and its future impact play a key role in identifying deliverables, work effort, tasks, and responsibilities for the next Sprint.

A series of questions and objections was tallied next:

- Earned Schedule without EVM? You need to value the deliverables in units of measure that are meaningful to those paying the bill. You can't do without PV and EV.
- Estimates waste time! This is an objection often seen on Agile forums. There's no systematic evidence that supports it, nor is there an explanation of how to control change without it.
- What if we need a new baseline? Rule of thumb: three or more consecutive measurements in breach of threshold headed in same (bad) direction. New baseline, new project.
- "Project status" is nonsense, just attend daily stand-ups! Managers have fiduciary responsibility but can't realistically get info from stand-ups. Projects need to provide the data.
- Even if we get the numbers, isn't more important to produce useful deliverables? The webinar showed that it's possible to do both: to make reasoned decisions and produce other useful deliverables.

In summary, for project success, you must both Act Fast and Think Fast—combine Agile and Earned Schedule.

5 Paulo André de Andrade - The PL Categorizer

Paulo became aware of Earned Schedule in 2007 through course work on his master's degree. With expertise in technical translation, he translated some of Walt Lipke's articles and both of his books into Portuguese.

Paulo published articles and gave presentations on Earned Schedule. Some Brazilian companies began using ES, but adoption has been slow. Once use of EVM increases, ES adoption will increase.

Paulo developed Abacus, an Excel spreadsheet to serve as a demo and instructional tool for ES. It's available for download from Walt's Earned Schedule website.

Paulo then developed an executive project reporting service through his company Techisa Abacus. It features an Excel/VBA application that performs ES analysis and presents results in tabular and graphical form.

Paulo conducts research on ES. He's pursuing a Ph.D. with Prof. Mario Vanhoucke at Ghent University. Paulo's research focuses on determining the reliability of a project's forecasted completion. He's exploring whether or not the shape of the Performance Measurement Baseline (PMB) affects estimate reliability.

Paulo proposed a reliability categorizer based on the PMB shape. First, he created a measure of schedule topology: the degree to which the schedule is serial (S) or parallel (P).

Next, he introduced Batselier and Vanchoucke's Regularity Indicator (RI). Projects with higher RI yield better forecast reliability than other projects. And, they are more accurate than the SP indicator.

Paulo combined SP and RI to produce a third categorizer, the PMB Limits Categorizer (PLC). Rather than taking a theoretical approach, he pursued an empirical one. He used empirical data and statistical analysis techniques to identify limits for the PMB curves.

Regular (R) PMB curves were contained within Inner Limits. Irregular (I) PMB curves fell outside the Outer Limits. All other curves were called Medium-regular (M). The position of the PMB curve within the limits was determined by its deviation from a central line.

Paulo used the Batselier and Vanhoucke repository of real project data for his research. He extracted 100 projects out of the 133 projects in the data base, using selection criteria

developed by Vanhoucke and Martens. He normalized the data and used statistical analysis to identify the central line. From this, he constructed the limits and moved to categorize projects.

Paulo used real data to test the approach. The average curve for the data had an unexpected shape. Rather than an S-curve, it approximated a straight line (with some irregularities). Construction projects constituted 75% of the sample, and they are known to be mostly serial. That accounted for the shape of the curve. These projects became the focus of additional research.

Paulo applied statistical techniques to smooth out irregularities in the construction data. The smoothed line was the basis for the limits. They are placed at a fixed distance from the central line. The distance varies depending on the data, and a single parameter is used to control variation in the calculations.

Given the limits, Paulo partitioned the sample projects into R and I categories. Further statistical analysis produced a measure of "forecasting goodness".

Applied to the sample, the categorizers were ranked. PLC showed the best results in categories balance, clustering quality, and correlation. Also, for the R category, the PLC showed the best mean absolute percentage error.

Conclusions: PLC was superior to SP and RI in the study. It fits construction projects best and small projects rather than large ones.

For future research: validate PLC for megaprojects, sectorize the central line and limits (once more data is available), and create guidelines for using PLC in project planning.

6 Mario Vanhoucke - 20-Year Academic Research Journey in One Presentation

At the start of his "journey", Mario focused on algorithms for constructing simulated schedules. He found that his students in business school were more interested in risk analysis and project control than algorithms.

In 2003, things changed. Walt Lipke published "Schedule Is Different". For Mario, it was a "seminal" work—it strongly influenced him to move his career in a different direction.

First, Mario embedded Earned Schedule in his research. In a simulation study with Stephan Vandevoorde, he confirmed the accuracy of ES versus other metrics.

Then, a separate study showed that, given true scenarios, ES beat other metrics. But, for false scenarios, ES was not as good. Mario interpreted this as showing that ES is harder to mislead than other metrics. "Garbage in, garbage out" as he put it.

Another separate study showed that, in serialized schedules, ES performed well, but in parallel schedules, its results were not as good.

Around 2008, Mario researched the effect of control on project performance. He measured the effect by comparing the effort it required vs the impact that it produced. The best combination is low-effort time and cost control and high-impact corrective action to recover.

Given this yardstick, he found that standard measures such as Earned Schedule worked better with serialized schedules than with parallel schedules.

From 2009-2013, Mario moved beyond the academic environment, engaging professionals in the field. He obtained a large research grant that enabled him to publish the formulas behind his work on project control.

The research showed that standard measures were “easy” and produced “good” results, whereas statistical control was “difficult” but produced “very good” results. Mario developed Analytical Project Control which was both “easy” and “very good”. He connected it to corrective actions and validated it empirically.

In 2015, Mario addressed the gap between simulated and real schedule data. The former were academic, general, and statistically distributed. The latter were professional, specific, and not statistically distributed. Data calibration performed statistical analysis of historical data and applied curve fitting and human expertise to calibrate them. Calibrated data produced superior predictions.

The following years witnessed testing and evolution of Calibration. Each successive round improved the accuracy of data distribution, scaling up from 50% to 97%. In short, give the data to calibration and get back the real distribution.

And Mario’s journey continues… He and his team are researching resource skills, machine learning, protective/preventive risk control, action optimization, and contracts.

Finally, in addition to the “hard” skills of analysis and calculus, Mario foresees research into “soft” skills such as creativity and communications.

7 Mick Higgins - Telling the Time in the UK

Mick described the introduction of Earned Schedule into the United Kingdom. It appeared first at a conference in 2005, followed by publication of Mick’s article, “Can You Tell the Time?”

That article was, globally, the first publication in a chartered membership organization [namely, Journal of the Association of Project Management, August/September 2006].

It explained ES theory and documented how it was used on a Ministry of Defense program.

In 2010, the Association of Project Management (UK) recognized Earned Schedule as an emerging practice.

That was followed in 2011 by the Project Controls Expo. It was the largest event for project control in the UK, acting as a platform for theory, practice, and lessons learned. The expo featured presentations on Earned Schedule.

In 2019, ES was adopted as part of the project controls suite by Network Rail. Network Rail is responsible for rail infrastructure in the UK. Deltek implemented controls for the project and in Acumen Fuse included ES metrics.

Mick then gave a brief presentation of the Earned Schedule feature in Fuse. Mick noted that users can customize existing indicators and create new ones. Fuse works on files imported from [Primavera] P6 and [Microsoft] Project.

8 Yancy Qualls - Do you trust your IMS? ES vs. IECDs Showdown

After introducing himself, Yancy set his challenge: which is better Earned Schedule's Estimated Completion Date (ES) or an Independent Estimated Completion Date (IECD) derived from BCWS* and BCWP?

Yancy noted an asymmetry between reactions to cost and schedule forecasts. If in years 1 and 2, the BCWP=200K and ACWP=246K, the cost variance is -46K. If in years 3 and 4, the BCWR=200K and estimate for completion ETC=153K, the cost variance is +46K. Credible? No! Nobody would believe that the project will finish on budget.

But, if the Critical Path showed a current lag of 57 periods from the baseline but most of the schedule remained available, the planned finish would likely remain intact. Many would accept that the time could be "made up" before the planned finish.

Optimism bias makes actual data from projects unreliable. We cannot trust claims that the estimated finish is still in place.

Instead, Yancy proposed to determine which duration estimates were reliable. That presented another challenge.

EAC and ETC metrics are mature, offering several formulas. We can identify the formula that best fits. By contrast, IECD calculations are not as mature, and we don't know which has the best fit.

So, Yancy built a simulator that performed several types of IECD calculations simultaneously. That enabled him to compare the results to those from ES' EACt.

Yancy's IECD calculations*:

- BCWS-based: IECD = Time Now + BCWR / BCWS(current or average)
- BCWP-based: IECD = Time Now + BCWR / BCWP(average)
- SPIt-based IECD = Time Now + PDWR / SPIt(current or average)
- SVt-based IECD = Time Now + BL Complete + SVt
- CP-based IECD = CP finish = BL Finish

To make the simulation more realistic, Yancy added variations in start and end dates, ramp up and down, slower and faster rates, smoother and rougher curves. He also varied project length, took data from different points in the project timeline, and varied the size of the window.

Yancy demonstrated the simulator, looping through several scenarios. In each run, the generated estimate that came closest to the given end date was measured and stored.

What were the results of his investigation?

Yancy reported that SPIt was "almost always" the best, and SVt was the next best. The worst performer was the BCWS-based estimate. The most stable was the SVt.

Yancy's conclusion was that schedulers should use and report ES and the EACt (which is based on SPIt).

* BCWS=Budgeted Cost of Work Scheduled, aka PV; BCWP=Budgeted Cost of Work Performed, aka EV; BCWR=Budgeted Cost of Work Remaining; PDWR=Planned Duration Work Remaining; BL=Baseline; CP=Critical Path; EACt=Estimate at Complete for time; SPIt=Schedule Performance Index for time; SVt=Schedule Variance for time.

Close. The PGCS organizers thanked the following organizations for their sponsorship…

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About the Author

Robert Van De Velde

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Robert Van De Velde, Ph.D. is a practitioner. In the past 35 years, he has served as PM or PMO-lead on over two dozen projects and programs. They have ranged in size from six to nine figures and have been completed in domains from business to government.

Rob discovered Earned Schedule in 2007 and began using it on his projects. It worked so well that he started a company, ProjectFlightDeck, to make and sell software focused exclusively on Earned Schedule (see https://ProjectFlightDeck.com/Products.php).

Rob shares his ES knowledge and experience through a blog (EarnedScheduleExchange.com), vlog (EarnedsSheduleAcademy.com), and professional journals such as Project Management World Journal.

He also posts on LinkedIn groups, hashtags, and his company site (ProjectFlightDeck).

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For a full bio, see https://www.linkedin.com/in/robvandevelde. While you're there, please follow us at linkedin.com/company/projectflightdeck