Earned Value Management – Part 1

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Presenter Info: J. Fletcher Hearns

Fletcher Hearns is the Director of Technology Solutions and CTO with Edwards Performance Solutions (www.EdwPS.com).
He is responsible for the implementation of technology solutions for EdwPS clients including Enterprise Project Management (EPM) as well as overseeing the custom application development performed around enterprise solutions and Microsoft Project (Desktop & Server). Fletcher is also one of the lead trainers at EdwPS in various aspects of Project Management and the use of Project Management tools. Prior to joining Edwards Project Solutions, Fletcher spent seven years as the Director of Engineering at ODS Medical, a firm specializing in the development of systems used in the medical industry for digital diagnostic image dissemination and recording. Earlier in his career Fletcher held various positions that involved the design, development and project management of complex high-performance systems used in the financial and online gaming industries. Fletcher is a certified as a Project Management Professional (PMP), PMI Scheduling Professional (PMI-SP), PMI Agile Certified Practitioner (PMI-ACP) as well as a Certified Scrum Master (CSM). In addition, Fletcher has been certified by Microsoft as an MCTS in Microsoft Project and Microsoft Project Server.

Earned Value Management – Part 1

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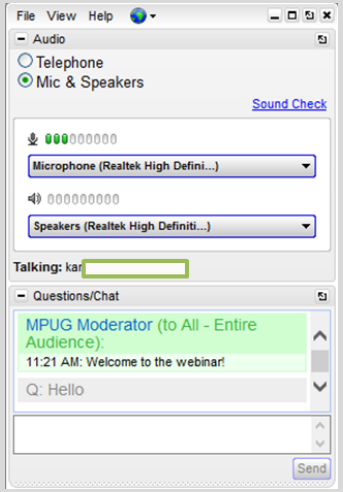

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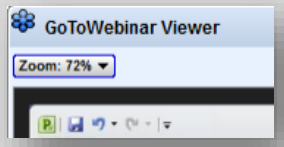

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Earned Value Management – Part 1

Earned Value Management – Part 2 – Using Microsoft Project

Earned Value Management – Part 3– EVM Reporting

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An Overview of Earned Value Management (EVM)

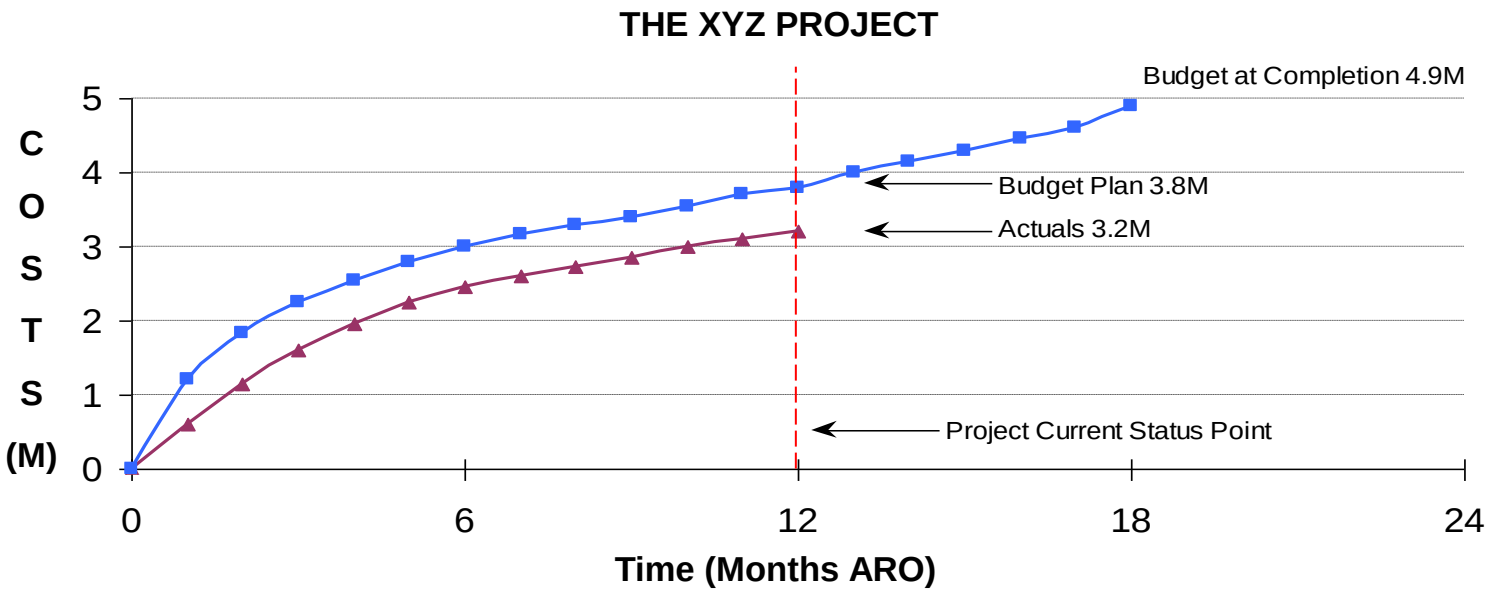
Using EVM to Track Progress

EDWARDS
PERFORMANCE SOLUTIONS

Using Earned Value to Track Progress

- What can you tell me about this project?
  - Is it… on schedule, ahead schedule, or behind schedule?
  - Is it… on budget, over budget, or under budget?

Will the project finish on time?

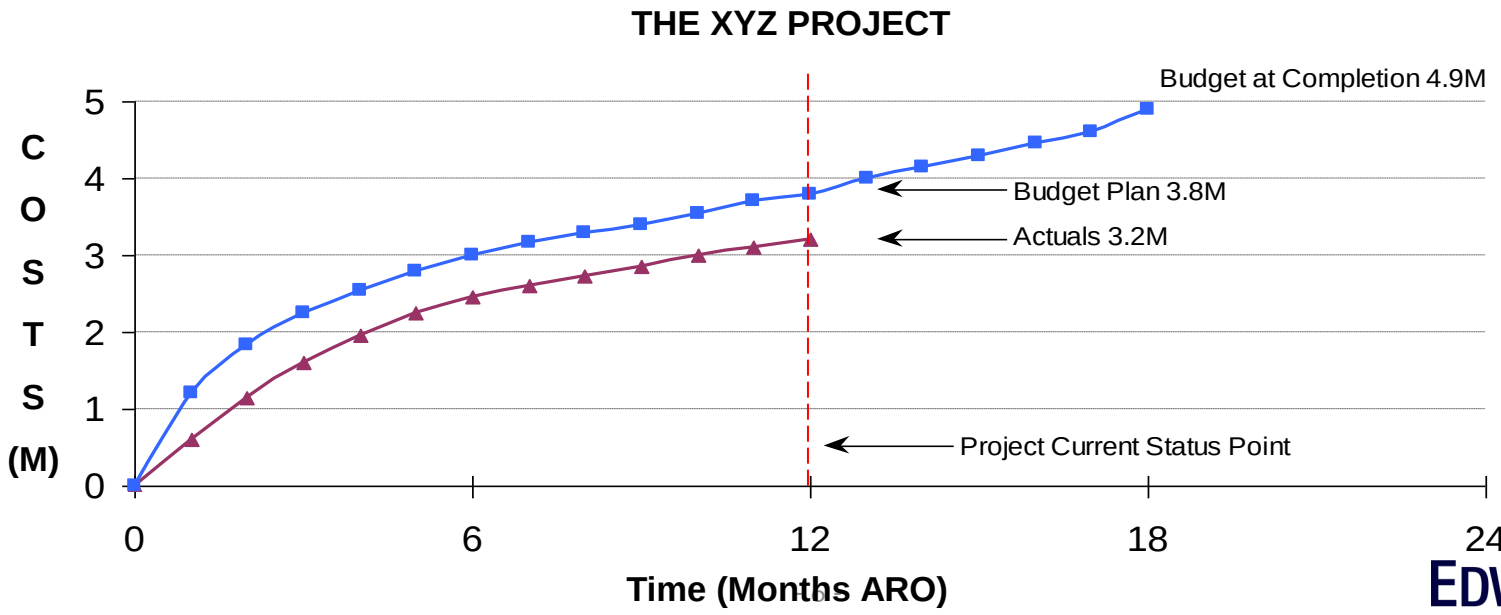


EDWARDS PERFORMANCE SOLUTIONS

Using Earned Value to Track Progress

- We know the original budget (the plan) (Blue Line)
- We know what we spent to date (Red Line) --BUT--
- Without additional information to show the project status we DON'T know what progress we have

-- Earned value metrics can give us the whole picture --



EDWARDS PERFORMANCE SOLUTIONS

Using Earned Value to Track Progress

Using Earned Value to Track Progress

Definition of Earned Value Management

*An Earned Value Management System (EVMS) integrates the project work **scope** with the **schedule** and **cost** elements of the project to optimize status and control*

History of Earned Value Management

- Origin: Cost/Schedule Control System Criteria (C/SCSC) required on major DoD projects starting in 1967
  - Goal: One set of project cost and schedule performance data to serve contractor and customer needs
  - Application focus from accounting system to program management system
- Currently: Since 1999, the industry standard (ANSI/EIA-748) was accepted by DoD for its projects and by other Federal departments
  - American National Standards Institute/Electronic Industry Alliance (ANSI/EIA) 748
  - Office of Management and Budget (OMB) Circular A-11 Part 7: Preparation, Submission, and Execution of the Budget

What is Earned Value – A Brief Synopsis

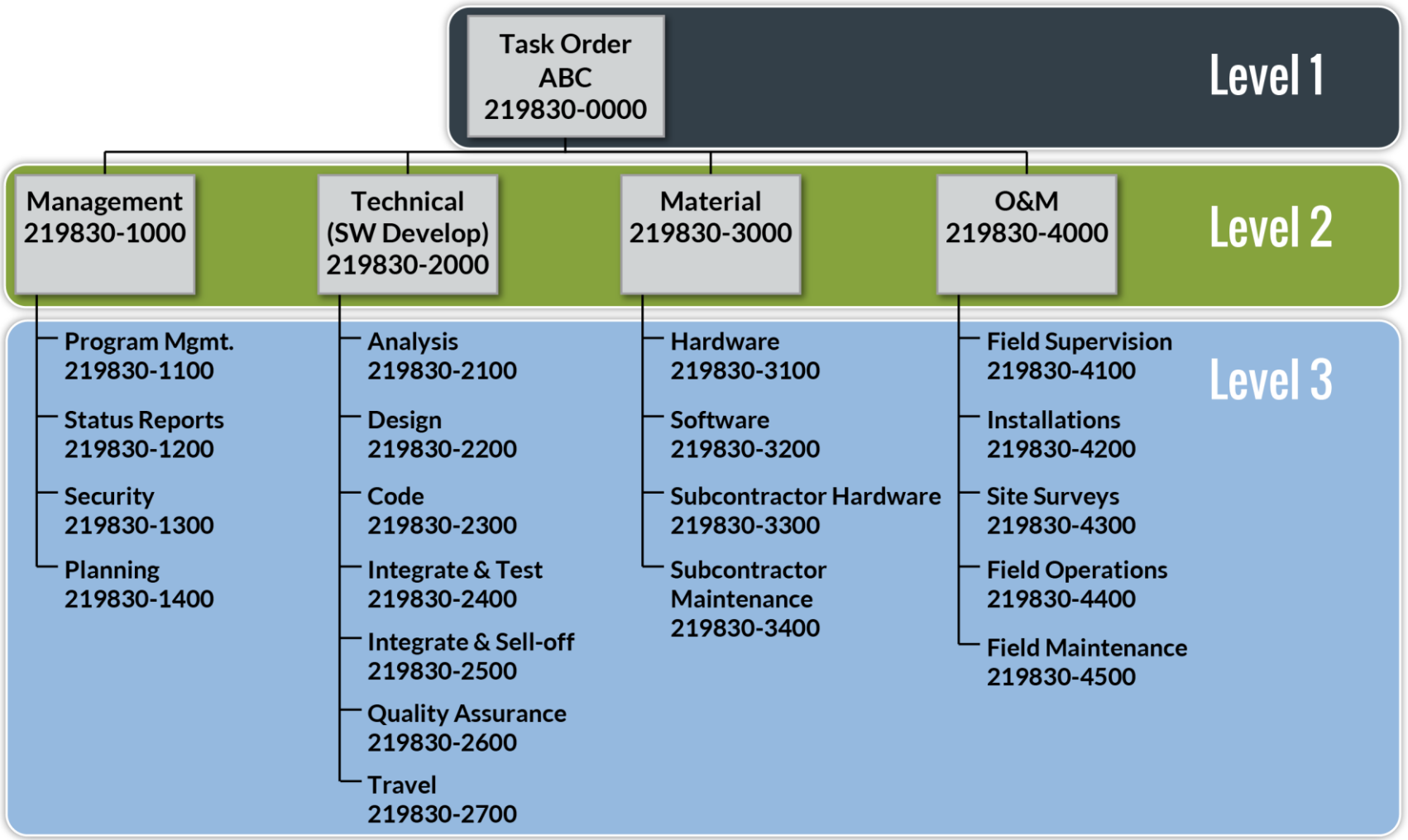
What is Earned Value – A Brief Synopsis

- EVMS is based upon breaking the project into manageable pieces called “Work Packages”
  - Each work package defines a piece of the work to be performed. It can define several activities or tasks and the resources required to perform them
  - Each activity (task) will have one to several resources assigned
    - Therefore the activity’s “Work” may be greater than the duration
  - Work packages may also have “Other Direct Costs” (ODC) assigned such as materials, subcontractors, vehicles, etc.

What is Earned Value – A Brief Synopsis

- EVMS is based upon breaking the project into manageable pieces called “Work Packages”
  - WP Budget = (work assigned to each resource) x (resource’s rate) + ODCs (Other Direct Costs)
  - The work package will also describe how this “Budget” will be expended across time - i.e.; The Work Schedule
  - Each work package must have an evaluation criteria for determining the percent completion of the activity (task) – *“what means done”*

Work Packages – Part of WBS Structure



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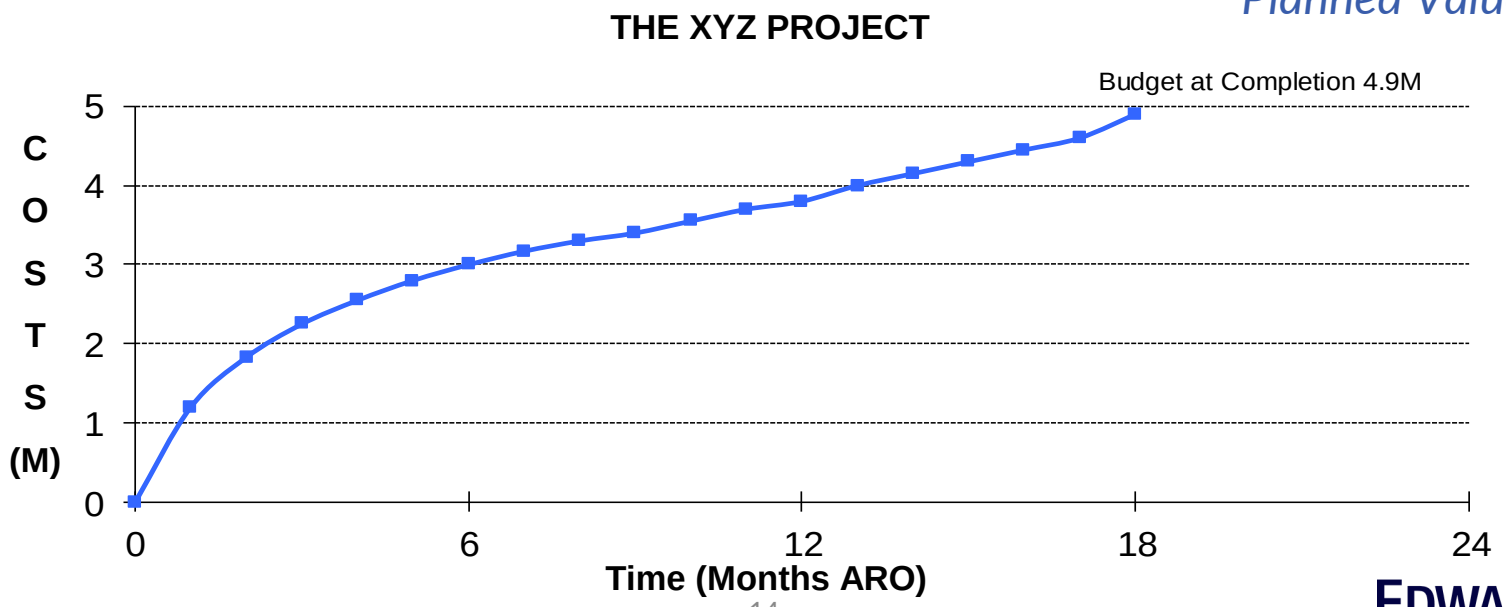
PERFORMANCE SOLUTIONS

What is Earned Value – A Brief Synopsis

- EVMS is based upon breaking the project into manageable pieces called “Work Packages”
  - The work packages are then added together across time to create a “Plan” for the project

(blue line on “The XYZ Project” Planned Value (PV))



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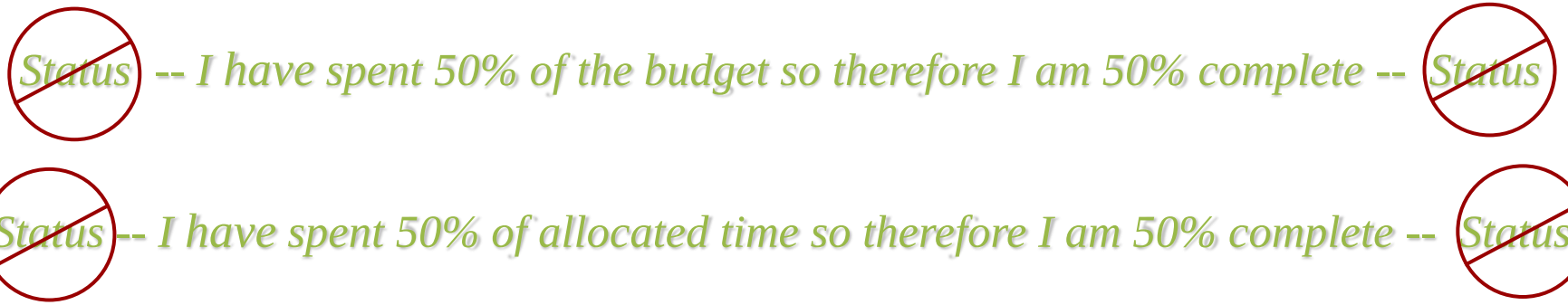
What is Earned Value – A Brief Synopsis

- Then the project starts and…
  - As the work packages are completed and the performance is evaluated (against the WP evaluation criteria), value is "**Earned**" against the planned cost (PV) of the work package
    - Earned Value (EV) = the "Value" of the work completed (based on PLAN)

Therefore… The value "Earned" against work packages is NOT linked to the actual **cost** or **time** to perform or complete the work



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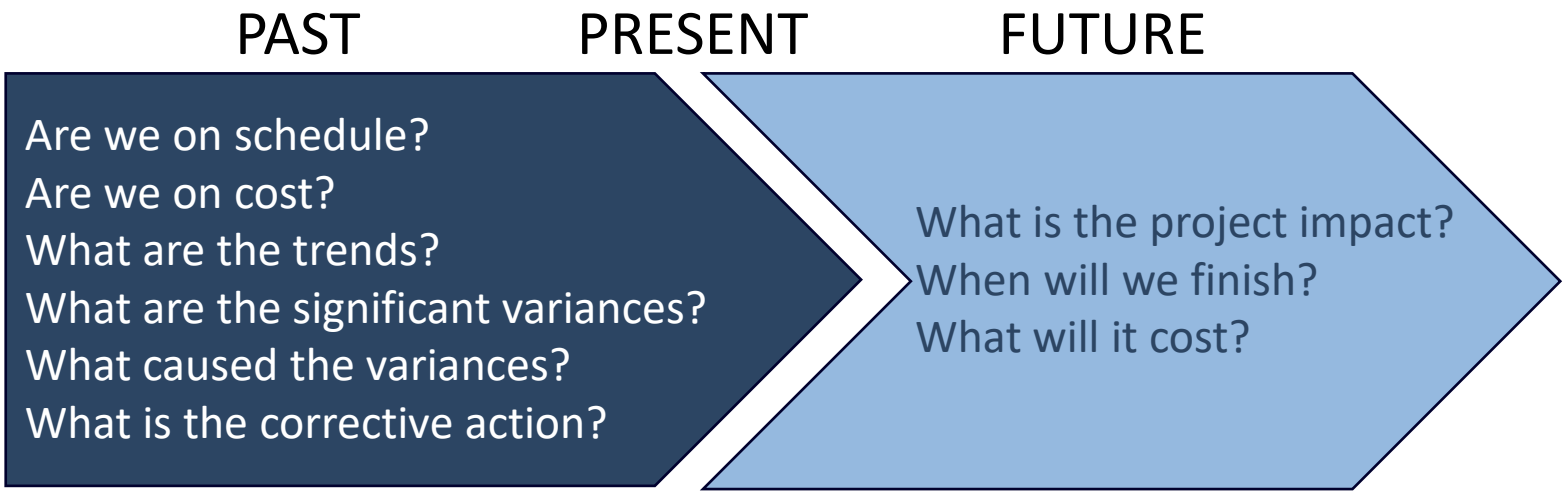
Using Earned Value to Track Progress

Using Earned Value to Track Progress

We analyze PAST performance… to help us manage the FUTURE



EVM provides early warning: It does not eliminate technical problems

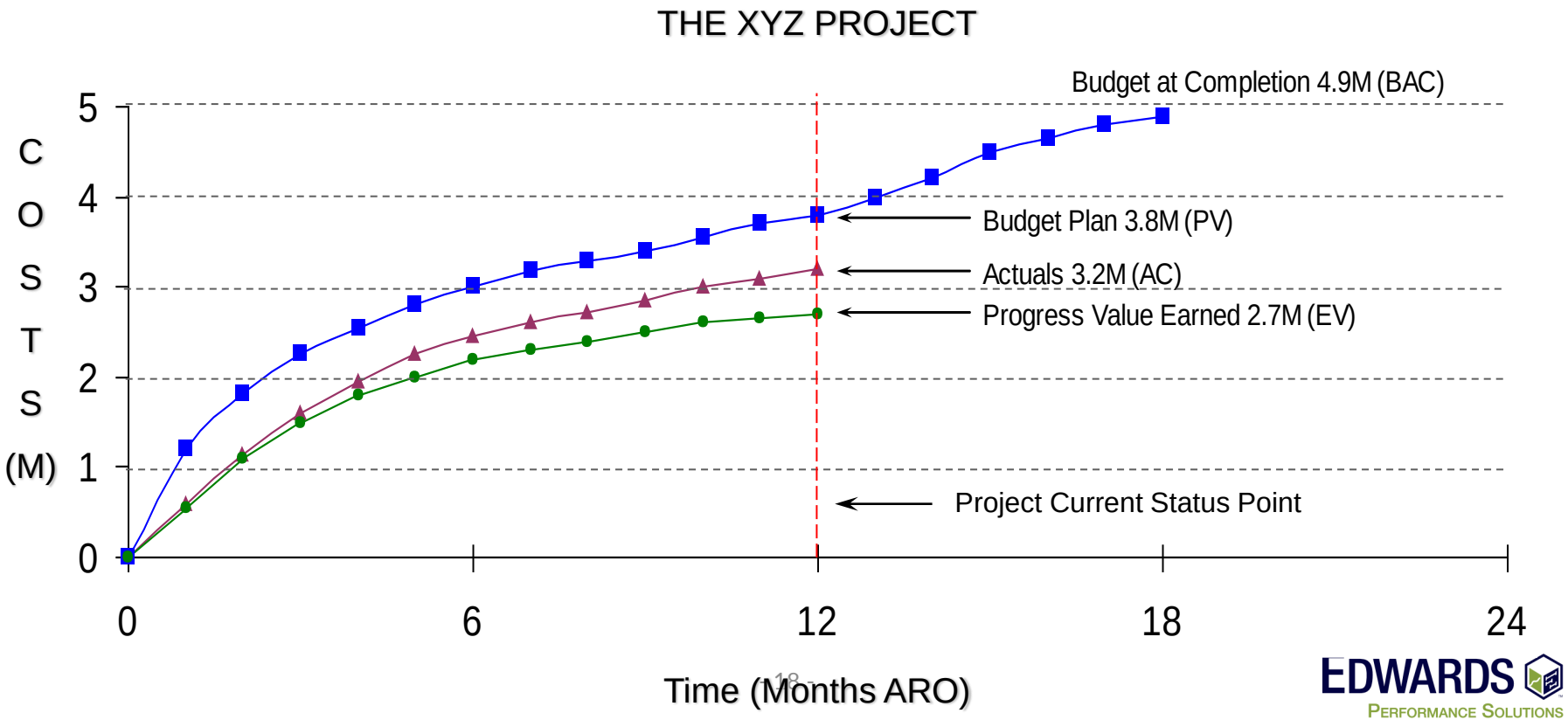
EDWARDS PERFORMANCE SOLUTIONS

Using Earned Value to Track Progress

- So lets take another look at “The XYZ Project”

  This time with earned value performance information included…

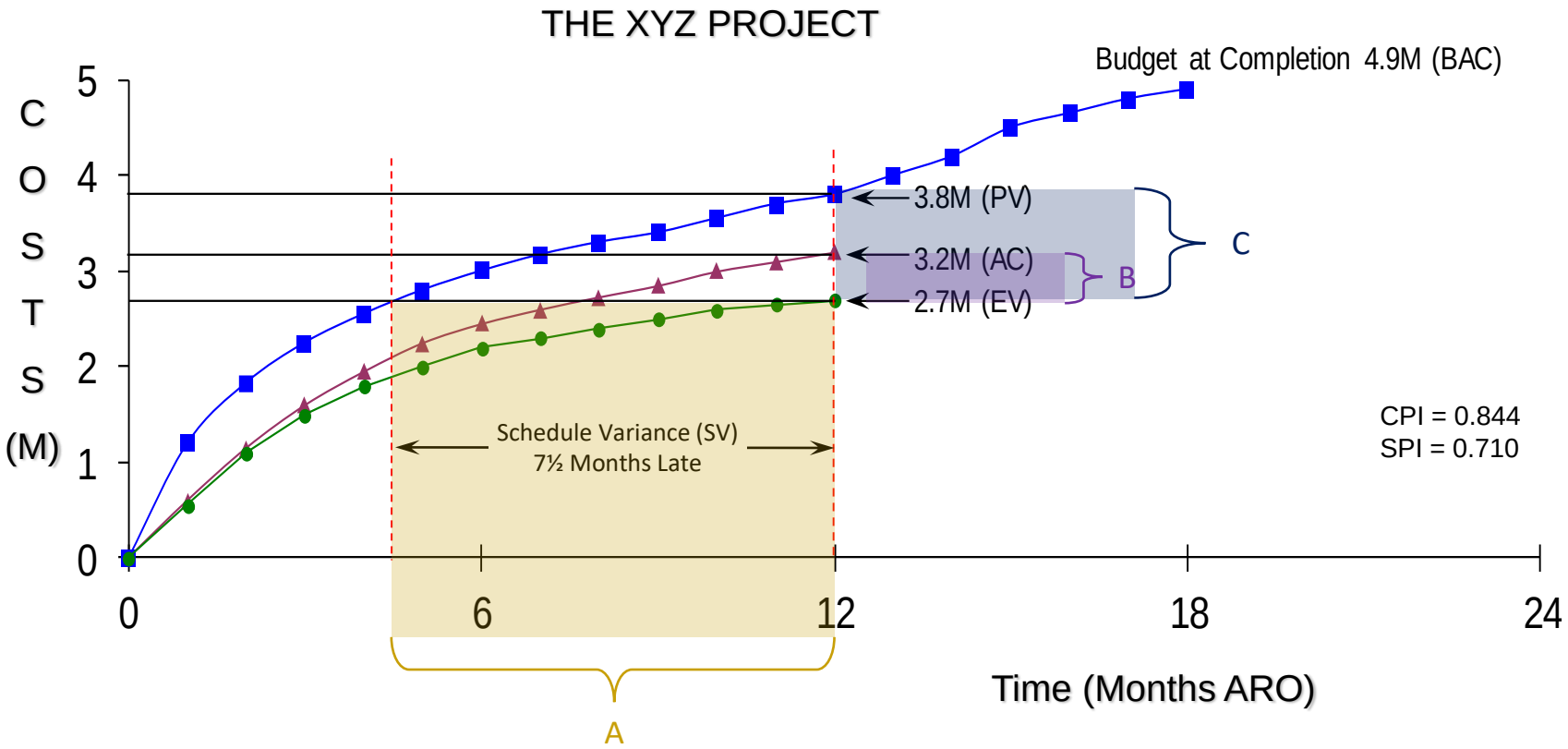
  …and we now see *THE REAL STORY* of our project! (Green Line)



EDWARDS PERFORMANCE SOLUTIONS

Using Earned Value to Track Progress

- Let's look at some key measurement examples



"A" - This distance reflects the amount the project is behind schedule at the current status time (7½ months late)

"B" - This reflects the cost variance (CV) in dollars (CV=EV-AC = $0.5M)

"C" - This reflects the schedule variance (SV) in dollars (SV=EV-PV = $1.1M)

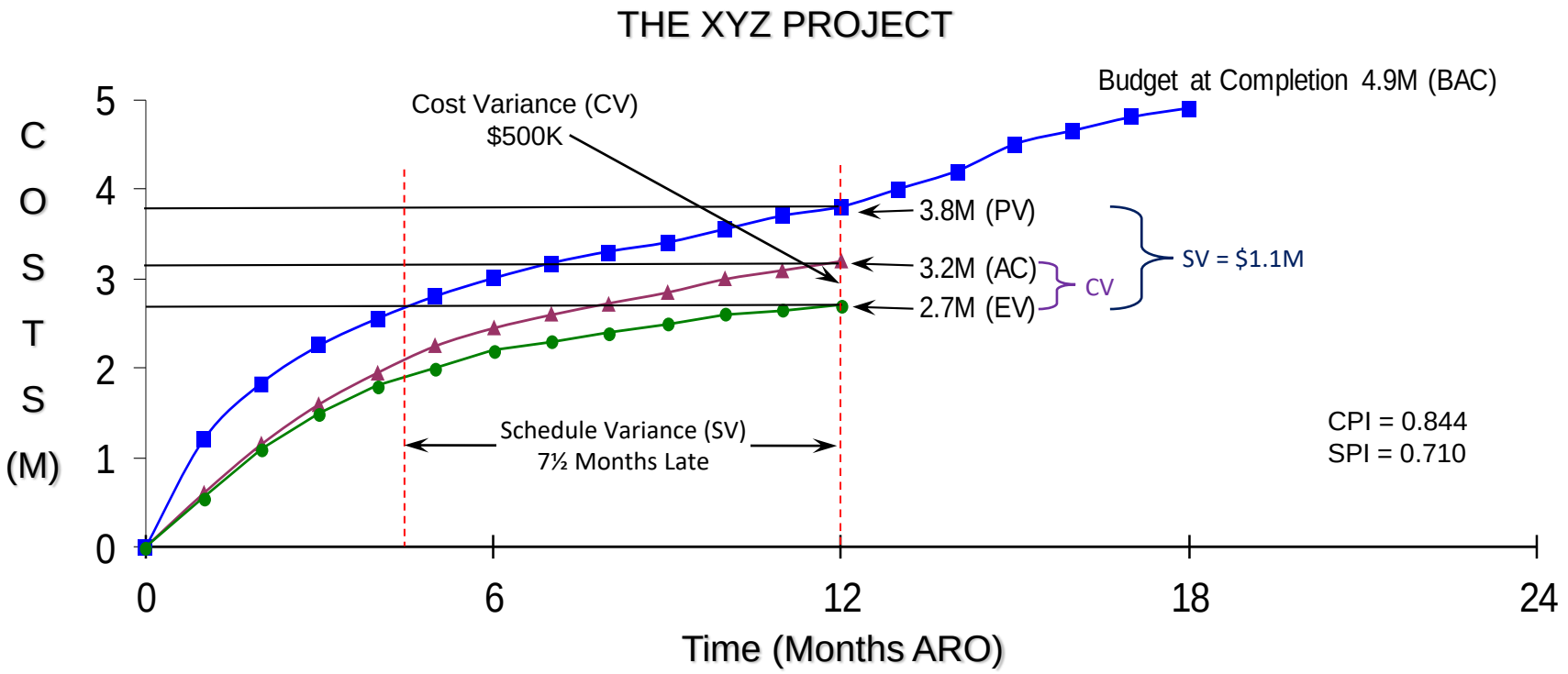
EDWARDS PERFORMANCE SOLUTIONS

Using Earned Value to Track Progress

- So in summary – The Real Story of "The XYZ Project" is
  - We are 12 months into an 18-month, $4.9M project
    - Two-Thirds through the original schedule duration
  - The project is 7 ½ months behind schedule – "A"
  - The project is $500K over budget – "B"
- What do you think the probability is to get this project completed within the schedule and cost constraints?

Using Earned Value to Track Progress

- …And when should we have started asking the "tough questions"…?



EDWARDS PERFORMANCE SOLUTIONS

Methods for Establishing the EV

Methods for Establishing the EV

- What work was accomplished in the baseline plan?
  - Three methods
    - Discretely measurable (several methods)
      - Objectively measured performance
      - A large majority of project tasks should use these methods
    - Apportioned effort
      - For tasks with a direct performance relationship to another discrete task(s)
      - Example: QA and Testing – amount of QA and Testing as percentage of other work on project.
    - Level of Effort (LOE)
      - For tasks with no practical way to measure progress
      - An ***"allowed exception"*** to genuine EVM, under limited circumstances
      - EV = PV with the passage of time (i.e., not based on accomplishment)
      - Should be less the 10% - 15% of total tasking
    - Select EV method that provides the most objective physically auditable approach

Method 1: Estimated Percentage Complete

- What was accomplished?
  - Discrete methods for establishing the EV
    - **Method 1 – Estimated percentage complete**: based on someones judgment
    - It is a subjective assessment approach; therefore, minimize use and beware of:
      - The 95% syndrome
      - Assuming that the “time or dollars spent” on the activity equates to the % complete of the activity

Method 2 – The 0/100 Earned Credit

- What was accomplished?
  - Discrete methods for establishing the EV
    - **Method 2 – The 0/100 Earned Credit (Binary Milestone):**
      - No credit is taken for any incomplete work packages
      - Best for work packages that have a short duration (one month or less), for materials and for Firm Fixed Price subcontracts
      - Definitive and is the most conservative
      - Can skew the overall EV because credit is not given for partially completed work packages
      - Where most work package span more than one accounting period, it may appear that the EV is always behind when in reality it is not

Method 3 – The 50/50 Earned Credit

- What was accomplished?
  - Discrete methods for establishing the EV
    - **Method 3 – The 50/50 Earned Credit:**
      - Take 50% earned credit when a work package is started and the other 50% when it is completed
      - A compromise between Estimated Percentage Complete and Binary Milestone
      - Limited to work packages less than 2 months in duration
      - Other percentage ratios can also be used, such as 10/90, 25/75, etc. Be careful that the initial earned credit is not larger than the final earned credit (i.e., 80/20)

Method 4: Weighted Milestone

- What was accomplished?
  - Discrete methods for establishing the Earned Value
    - **Method 4 – Weighted Milestone:** Firmly established activities within a Work Package
    - A software module development Work Package would entail the following:

Milestone	% Credit Taken
Specification Complete	15
I/O Spec Complete	10
Design Complete	15
Code Complete	20
Debug Complete	25
Test/Demo Complete	10
Documentation Complete	5
Total	**100**

    - The EV for the Work Package is the total % of completed Milestones * the Work Package Budget

Method 5 – Unit Credit

- Accounting: What was accomplished?
  - Discrete methods for establishing Earned Value
    - **Method 5 – Unit Credit:** When planning and tracking is normally planned and estimated based on a quantity of units (e.g., number of drawings, books, servers installed, etc.), then the EV is computed by multiplying the total planned value times the ratio of the completed quantity divided by the total quantity required
  - So which one to use?
    - The basis of estimating the work package budget and its time phasing of resource is a likely determinant of which EV method will provide the best selection
    - The method that is chosen should be documented in the Work Package during the planning process

Earned Value Analysis

Earned Value Analysis

- Formulas helpful in Earned Value Analysis
  - Variance Measurements
    - Cost Variance (CV) = EV – AC
      - AC = Actual Cost
      - EV = Earned Value

      $2.7 – $3.2 = **-$.5M**
    - Schedule Variance (SV) = EV – PV
      - PV = Planned Value

      $2.7 – $3.8 = **-$1.1M**
    - Cost Performance Index (CPI) = $\frac{EV}{AC}$

      $2.7 / $3.2 = **.84**
    - Schedule Performance Index (SPI) = $\frac{EV}{PV}$

      $2.7 / $3.8 = **.71**
    - To Complete Performance Index (TCPI) = $\frac{(BAC - EV)}{(EAC - AC)}$

      $\frac{\$4.9M - \$2.7M}{\$4.9M - \$3.2M} =$ **1.29**

Earned Value Analysis

- Formulas helpful in Earned Value Analysis
  - Performance Indices
    - Cost Variance Percentage (CV %) = $\frac{CV}{EV}$ — $.5M / $2.7 = **18.5%**
    - Schedule Variance Percentage (SV %) = $\frac{SV}{PV}$ — $1.1M / $3.8M = **28.9%**
    - Variance at Completion (VAC) = BAC - EAC — $4.9M – ??M = $??M

Earned Value Analysis

- Formulas helpful in Earned Value Analysis (cont.)
  - Overall Status
    - Project Percent Complete (% Complete) = $\frac{EV}{BAC}$ x 100% $2.7M/ $4.9M = **55%**
    - Percent of Project Budget Spent (% Spent) = $\frac{AC}{BAC \text{ (or EAC)}}$ x 100% $3.2M/ $4.9M = **65%**
  - Estimate at Completion
    - Mathematical EAC = BAC - EV + AC = $EAC_{(math)}$ $4.9M -$2.7M + $3.2M = **$5.4M**
    - Cost Performance EAC = $\frac{BAC}{CPI} = EAC_{(CPI)}$ $4.9M / .84 = **$5.8M**
    - Composite EAC = $\frac{(BAC - EV)}{CPI \times SPI} + AC = EAC_{(comp)}$ ($4.9M - $2.7M) / (.84 x .71) + 3.2 = **$6.8M**

Earned Value Analysis

- Indicators to Look for in Earned Value Analysis

Measurement	 A Good Thing	 A Bad Thing
Cost Variance (CV)	0 or +	-
Schedule Variance (SV)	0 or +	-
CPI	≥1.0	<1.0
SPI	≥1.0	<1.0
VAC	0 or +	-
TCPI	≤1.0	>1.0

EVM Best Practices

Some EVM Best Practices

- Following good EVMS practices will yield good results
- Develop detailed work breakdown (WBS)
  - Develop tasks with specific/defined deliverables and labor assigned
    - What does done mean
  - Develop defendable (BOE) estimates for each task
  - Develop detailed schedule that "connects" to the WBS
- Use a scheduling tool and establish a project **baseline** to measure performance against
  - EVM cannot be calculated **without** a baseline
- Track labor hours expended against the project baseline
- Conduct regular reviews to determine schedule and overall project status
- Perform periodic Estimates to Complete (ETC)

Some Key EVM Definitions

- Performance Measurement Baseline (**PMB**): A time-phased budget plan against which project performance is measured
  - Also known as a Budgeted Cost of Work Schedule (**BCWS**) or Planned Value (**PV**)
- Work Breakdown Structure (**WBS**): A planned outcome-oriented grouping of project elements that hierarchically organize and defines the total work scope of a project; each descending level represents an increasingly detailed definition of a project's work
- Control Account (**CA**): A management control point at which budgets (resource plans) and actual costs are accumulated and compared to earned value for management control purposes; a control account is a natural management point for planning and control since it represents the work assigned to one responsible organizational element (or integrated work team) for a single program WBS element
- Work Package: A task or group of tasks associated with a control account WBS element scope; it is the point at which work is planned, progress is measured, and earned value is computed

EVM Definitions (continued)

- **Planning Package:** A holding account of time phased resources to defined scope within a control account for future work that is not practical to detail into work packages
- **Level of Effort (LOE):** Work based on project resources that does not result in a finite product or project deliverable; (i.e., management, administration, etc.); work is usually spread across an entire project or a portion of a project
- **Control Account Plan (CAP):** A project manager's planning and control point at a specific project's WBS element that is assigned to a single responsible manager or team leader (Control Account Manager, CAM); contains the following:
  - A single WBS element's scope
  - PV and EV
  - Actual costs
  - Estimate to complete
  - Associated cost and schedule variances with explanation, corrective action, and impact for significant variances

EIA EVMS Guidelines

- The American National Standards Institute (ANSI) and the Electronic Industries Alliance (EIA) standard guidelines for EVMS with standard ANSI/EIA-748 are available for a fee from Global Engineering Documents
  - Website: http://global.ihs.com/
- Purpose of guidelines
  - State the qualities and operational considerations of an integrated management system using earned value analysis methods without mandating detail system characteristics
  - Provide organizations the flexibility to establish and apply a management system that suits their management style and business environment

Questions?

To learn more about the topic of this presentation, please contact…

Fletcher Hearns

PMP, PMI-ACP, PMI-SP, MCTS, MCP, CSM

FHearns@edwps.com

443.561.1340