



PROJECT AND PROGRAM MANAGEMENT SYMPOSIUM
» Better Management » Better Projects

An Overview of Earned Value Management

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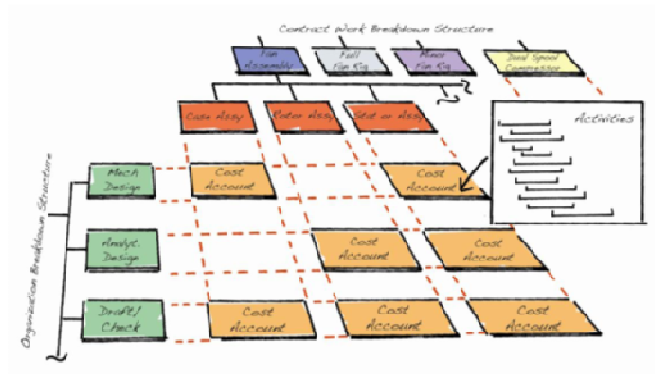
<https://mosaicprojects.com.au/PMKI-SCH.php>

The Key Elements

1. The project decomposed into management cells using an effective **WBS**
2. An effective schedule linked to the **WBS**
3. An effective cost plan linked to the **WBS**
4. Management authority and responsibility linked to the **WBS**

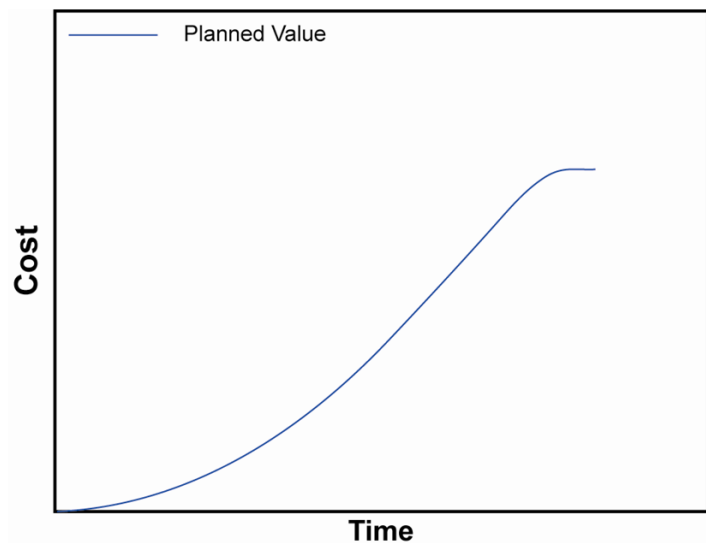
The Key Elements

- **Effective EVM needs 'work packages'**



Overview of Earned Value

- The foundation is a time phased budget



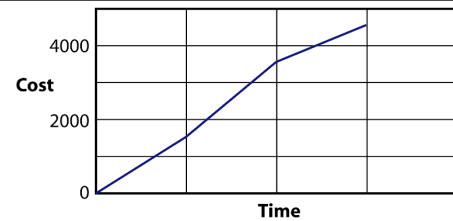
Overview of Earned Value

- Developing a time phased budget to 'write a specification'

Outline = 1000
 Write = 3000
 R & A = 500

Write Specification

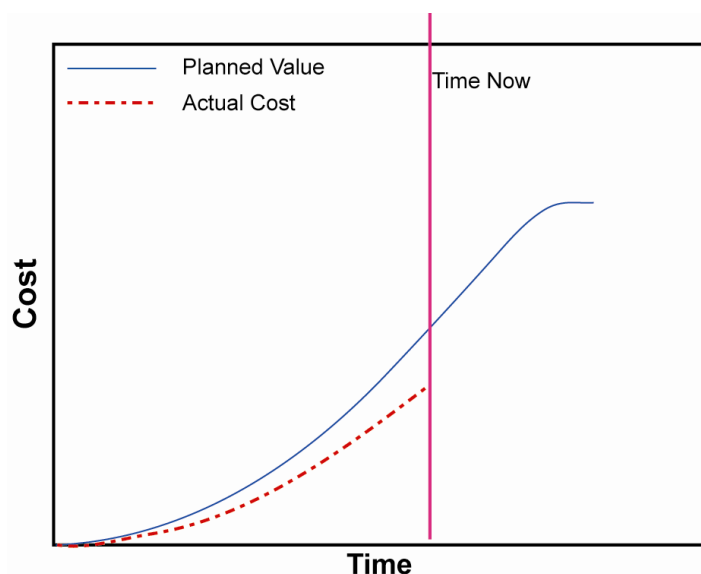
Month	1	2	3	4
Outline	[Progress bar]			
Write	[Progress bar]			
Review & Accept	[Progress bar]			
Outline	1000			
Write	500	2000	500	
Review & Accept			500	



Overview of Earned Value

- Measuring actual cost adds little extra value

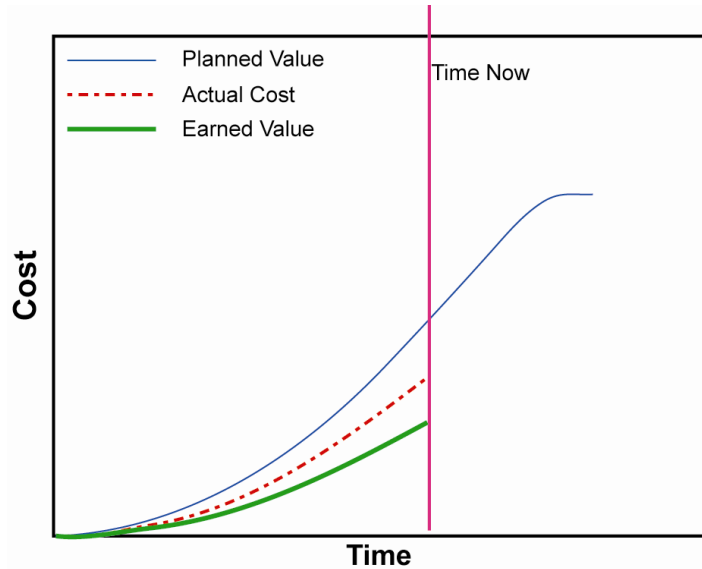
Is this project profitable or behind schedule?



Overview of Earned Value

- Earned value highlights the real situation

The project is losing money and behind schedule!



Time Phased Budget

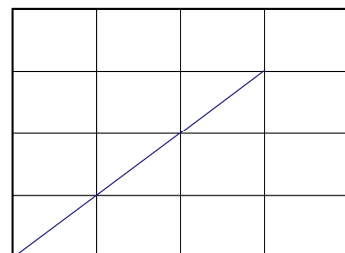
- Establish a time phased baseline
 - Work packages or planning packages
 - Scheduled dates
 - Allocated costs

Write Specification

Month	1	2	3	4
Outline	█			
Draft		█		
Review & Accept			█	

Cumulative Values

Planned Value	1000	2000	3000	



Earned Value

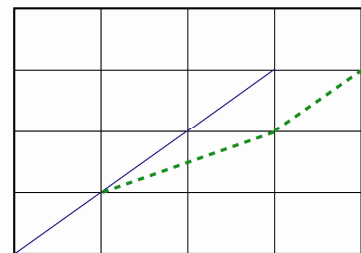
- Plot actual performance (Earned Value)
 - The Draft took two months to complete reducing the EV at the end of Month 2 and delaying the completion of the project

Write Specification

Month	1	2	3	4
Outline	█			
Draft		█	█	
Review & Accept			█	█

Cumulative Values

Planned Value	1000	2000	3000	
Earned Value	1000	1500	2000	3000



Actual Cost

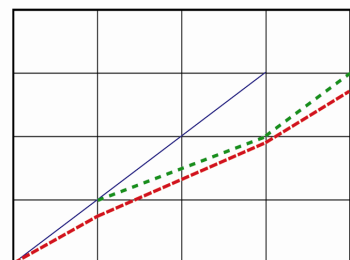
- Plot actual Costs
 - Actual Costs:
 - Outline = \$800
 - Draft = \$1100 (50% in Each month)
 - Review = \$900

Write Specification

Month	1	2	3	4
Outline	█			
Draft		█	█	
Review & Accept			█	█

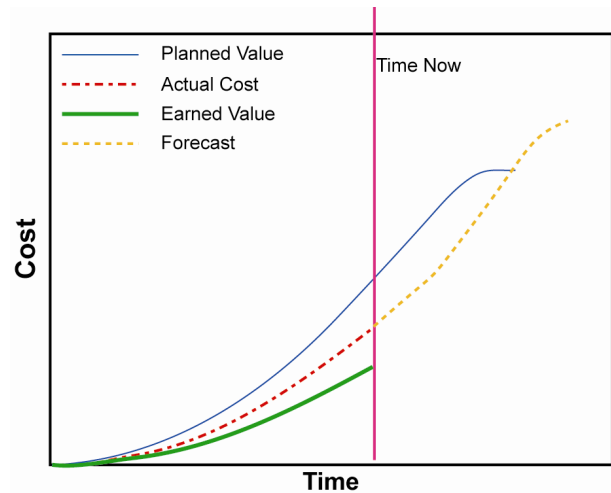
Cumulative Values

Planned Value	1000	2000	3000	
Earned Value	1000	1500	2000	3000
Actual Cost	800	1350	1900	2800



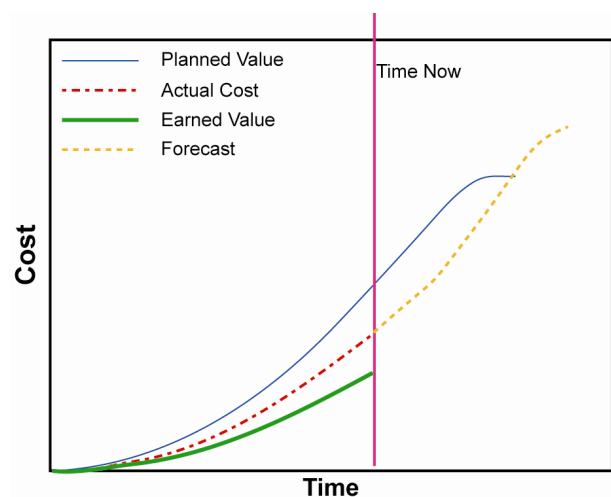
Summary - Earned Value

- Calculate the forecast to completion



Summary - Earned Value

- Calculate the forecast to completion
- Using defined formulae
(but not today)

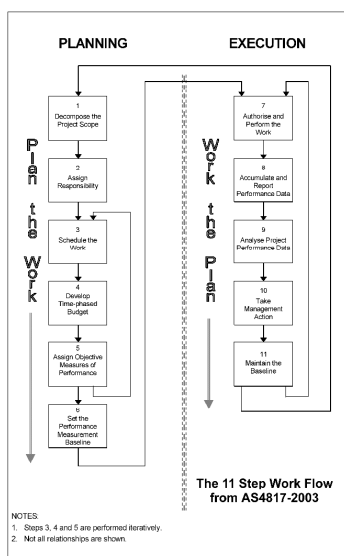


https://mosaicprojects.com.au/WhitePapers/WP1081_Earned_Value.pdf

AS 4817 (+ ISO 21508)

- Earned Value Performance Management
 - Basic Actions
 - What work, by whom & when
 - Realistic resources
 - Objective measurement of progress
 - Report significant deviations
 - Forecast completion dates/costs
 - Plan/implement corrective actions
 - Manage changes

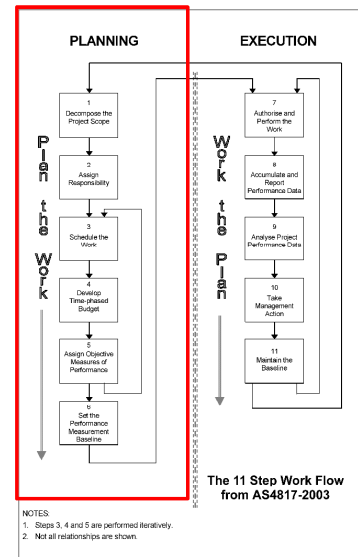
AS 4817 + ISO 21508



These 11 steps are consistent across
 AS 4817 2003
 AS 4817 2006
 ISO 21508 2018
 Proposed update to AS 4817
 (more on this in the closing session)

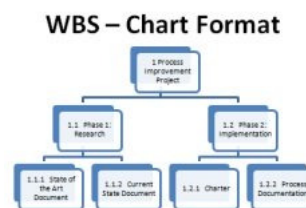
AS 4817 + ISO 21508

- Steps 1 through 6 create the plan and set the 'performance management baseline' (PMB) for the project



Step 1: Decompose the Project Scope

- Decompose via WBS
- WBS includes all work (100% rule)
- Scope of items mutually exclusive



- WBS – Outline Format**
- 1 Process Improvement Project
 - 1.1 Phase 1: Research
 - 1.1.1 State of the Art Document
 - 1.1.2 Current State Document
 - 1.2 Phase 2: Implementation
 - 1.2.1 Charter
 - 1.2.2 Process Documentation

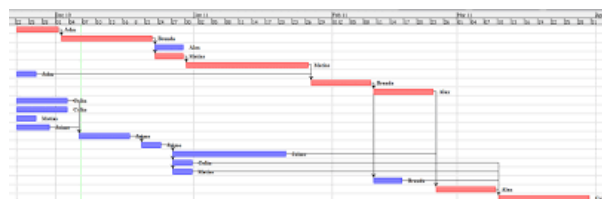
https://mosaicprojects.com.au/WhitePapers/WP1011_WBS.pdf

Step 2: Assign Responsibility

- Responsibility assigned
 - Each element
 - Project
- Responsibility clearly defined
- Internal managers for external work

Step 3: Schedule the Work

- Activities fit below work elements
- Key interfaces and constraints defined
- Sequences and interdependencies
- Objective measures identified



Step 4: Develop Time-Phased Budget

- Budgets assigned in measurable units
- Distributed over duration
- Budget for far term assigned and phased
- Management Reserve and Undistributed Budget
- Reconcile to Project Budget

Step 5: Assign Objective Measures of Performance

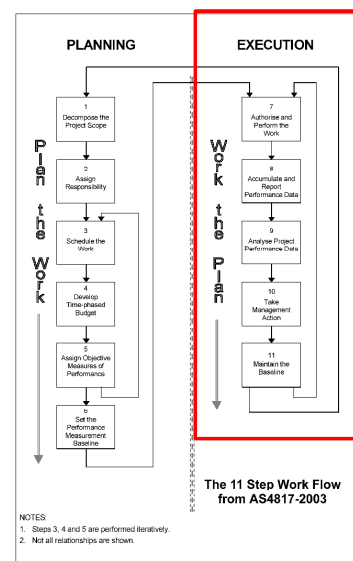
- Accomplishment expressed as EV
- Objective measures planned and set
- 1 measure per Work Package
- Progress and costs in same period
- EV at 100% complete = budget

Step 6: Set the Performance Measurement Baseline (PMB)

- Scope clearly identified and recorded
- Schedule clearly identified and recorded
- Budget clearly identified and recorded
- Scope, schedule, budget formally approved = PMB
- PMB is a controlled document

AS 4817 + ISO 21508

- Steps 7 through 11 manage the work of the project to achieve the PMB



Step 7: Authorise and Perform the Work

- Source of authority clearly defined
- Work planned before authorised
- Work authorised as planned
- Responsibility and measures clearly identified as part of authorisation

Step 8: Accumulate & Report Performance Data

- EV progress measured and accumulated
- Actual costs accumulated (including accruals)
- Schedule performance measured
- Data accumulated consistently and periodically
- Variances compared to the PMB identified
- Management receive regular & consistent data

Step 9 – Analyse Project Performance Data

- Schedule progress compared with baseline
- Schedule forecasts compared to plan
- EV progress compared with planned
- EV progress compared with Actual costs
- Variance analysed – corrective actions proposed
- EACs generated routinely and compared to budget (both for cost and time [ES])

Step 10 – Management Action

- Corrective actions developed and implemented
- Preventative actions developed and implemented
- Forecasts may be revised based on corrective actions and Baselines updated through change control
- No retroactive changes to performance data
- Corrective & preventative actions monitored

Step 11 – Maintain the Baseline

- Baseline changes controlled and approved
 - Scope
 - Schedule
 - Budget
- Changes documented and traceable
- No retroactive changes to plan

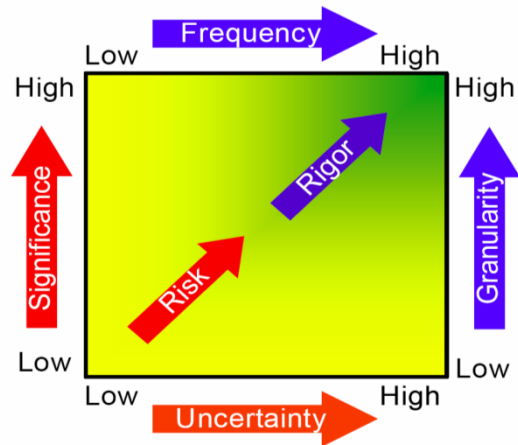
EV Management

- **Control has three components:**
 - Knowing what the 'in control' state is
 - Measuring the variance from that state
 - Acting to remove the variance
- Requires a practical tool set

EV Management

- Balance risk and rigour
- Adequate detail
- Sensible frequency

EVM Rigor as a Function of Project Risk



Analysing Performance Data

Performance Measures		Schedule		
		SV > 0 & SPI > 1.0	SV = 0 & SPI = 1.0	SV < 0 & SPI < 1.0
Cost	CV > 0 & CPI > 1.0	Ahead of Schedule Under Budget	On Schedule Under Budget	Behind Schedule Under Budget
	CV = 0 & CPI = 1.0	Ahead of Schedule On Budget	On Schedule On Budget	Behind Schedule On Budget
	CV < 0 & CPI < 1.0	Ahead of Schedule Over Budget	On Schedule Over Budget	Behind Schedule Over Budget

- The responsible manager needs to explain
 - What caused the variance
 - What is being done about the variance

Analysing Performance Data

- For each Work Package and Control account:
 - **What** is easy
 - **Why** is harder
 - **What** can be done about it requires skill
- **Focus on what matters!**

Variance Analysis Report							
Project	Bicycle			Report Period	Period-6		
Date	February 8, 2010			WBS Element	1.4.1 Braking System		
				Cost Variance		Schedule Variance	
	PV	EV	AC	CV	CV%	SV	SV%
Current Period	\$3,920	\$1,176	\$2,000	(\$824)	-70%	(\$2,744)	-70%
Cumulative	\$3,920	\$1,176	\$2,000	(\$824)	-70%	(\$2,744)	-70%
At Completion	BAC	EAC	VAC				
	\$11,440	\$12,000	(\$560)				

SCHEDULE VARIANCE
Problem Analysis - Cause
 Several delivered components from one vendor have failed receipt inspection, resulting in approximately \$3,000 of parts associated with the handle lever that were returned to the vendor for modifications. These parts were planned to be delivered by February 26, however they are anticipated to be returned on March 11. It is anticipated that the schedule variance will go to zero at that time.
Program/Task Impact
 The braking system is on the critical path of the program. Delays in these deliveries may impact all downstream activity including the shifting system, integration, assembly, and test. The anticipated impact to the braking system is a 2-week delay in completion.
Corrective Action Plan (Include Expected Recovery Date)
 The braking system team is working with the project manager and other component teams on a mitigation plan to recover some of the 2-week delay. Specifically, some component tests and product tests may begin without the braking system. In addition, we are working with the shifting system team to assess if activities can be performed simultaneously rather than serially as planned. Anticipate completion of the braking system by March 11, and program impact is still being managed and assessed.

COST VARIANCE
Problem Analysis - Cause
 \$560 of the cost variance is due to a higher than anticipated cost associated with the brake calipers and pads. The remaining \$264 is labor associated with managing early receipt of wiring components.
Program/Task Impact
 The \$560 pad and caliper overrun cannot be mitigated and is included in the braking system EAC. No impact projected for the labor variance.
Corrective Action Plan (Include Expected Recovery Date)
 The \$264 of labor variance is level of effort activity performed earlier than anticipated. Since the associated wiring components have arrived early, these LOE activities will not have to be performed when anticipated in late February, and the \$264 variance will go to zero at that time.
Impact to Estimate At Completion (EAC)
 Purchase orders released to vendors for braking system parts, primarily the pads and calipers, were negotiated \$560 higher than budgeted. Cost impacts associated with part inspection failures are still being evaluated, but a potential \$1,500 - \$2,000 EAC impact is possible.

Analysing Performance Data

- For each Work Package and Control account:
 - What is easy
 - **Why** is harder
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The trend is your friend

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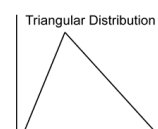
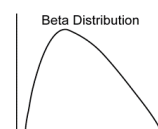
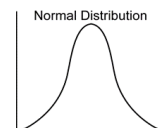
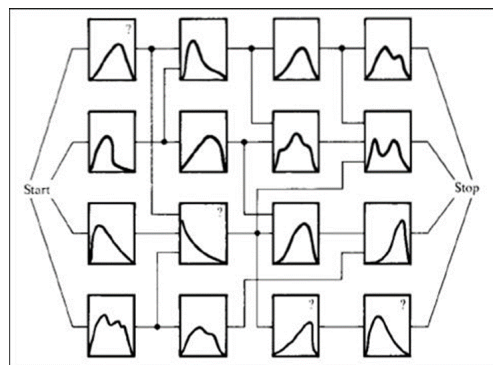
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Uncertainty / Risk

- There is no such thing as a 'risk free project'
- Every estimate is uncertain
- Every process has a degree of variability
- **Successful projects manage risk & uncertainty**

Uncertainty / Risk

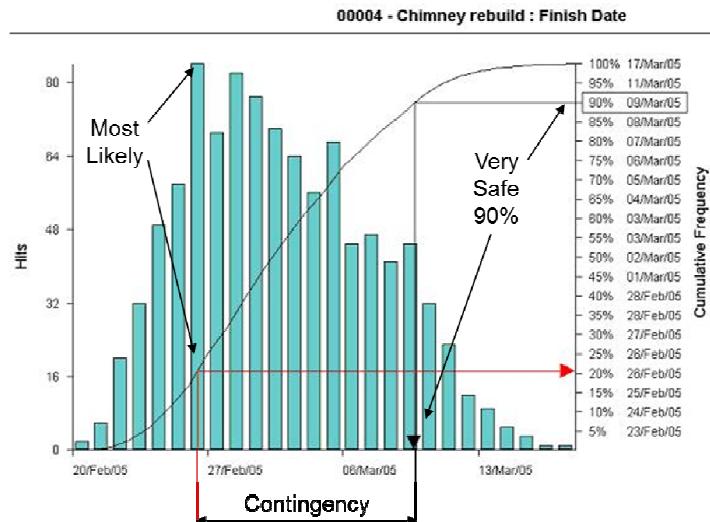
- Every activity has a range of possible outcomes



Uncertainty / Risk

- Monte Carlo Simulation

It involves running the project many hundreds (if not thousands) of times with different values selected for each element based on the range and distribution assumed for each task. This example looks at time. A similar analysis can be done for costs.

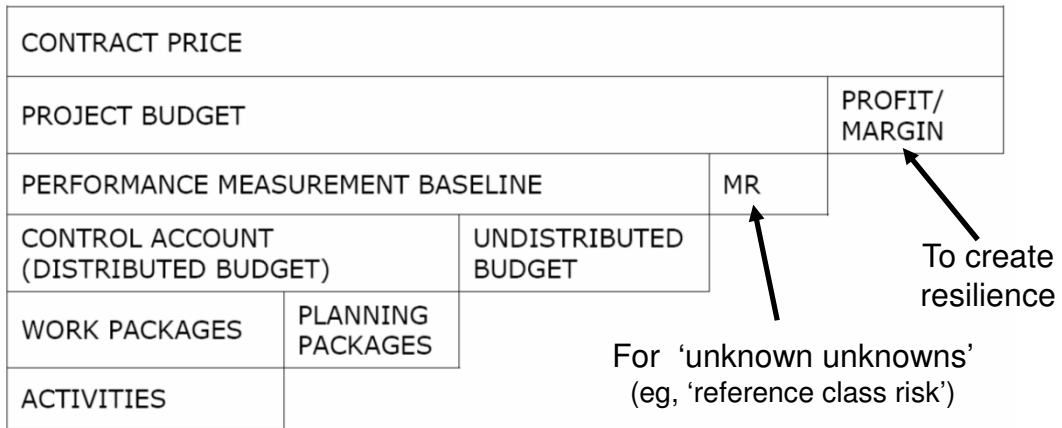


Contingency

- Monte Carlo provides an estimate of the contingency needed for normal variability in estimates
- Risk assessments provide an estimate of the impact of identified risk events
- General management assessments can estimate 'unknown unknowns'

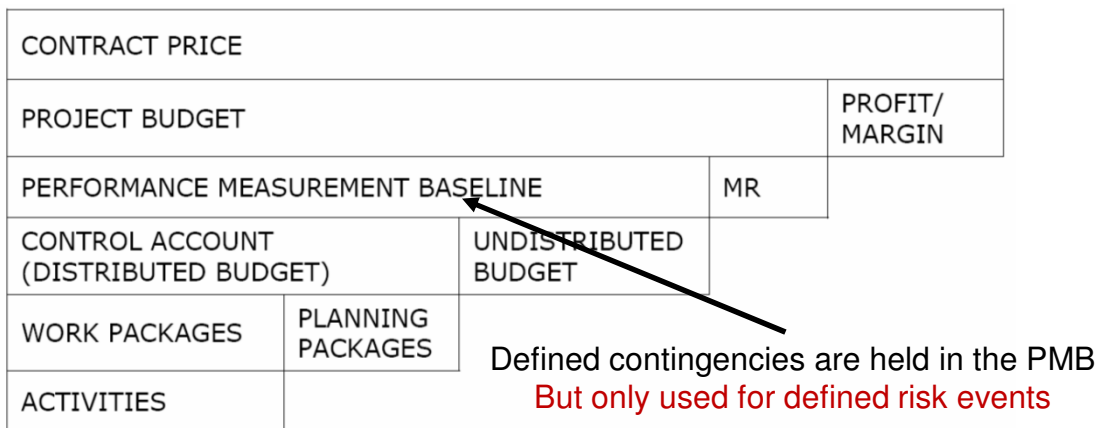
Contingency

- Performance Management Baseline



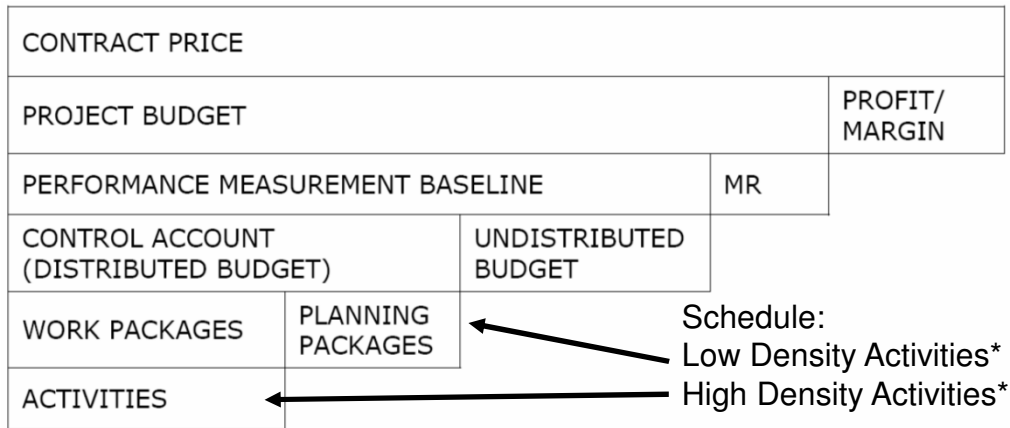
Contingency

- Performance Management Baseline



Contingency

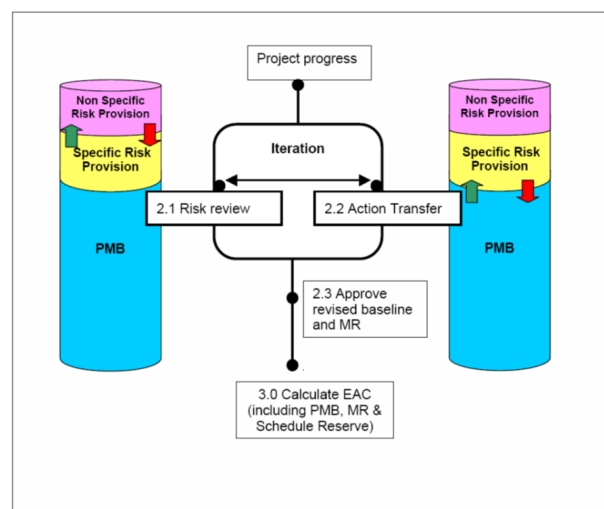
- Performance Management Baseline



* See: http://www.mosaicprojects.com.au/WhitePapers/WP1016_Schedule_Density.pdf

Contingency

- Integrated risk management
 - MR to PMB Contingencies
 - Unused contingencies back to MR
 - Contingencies to Work Packages

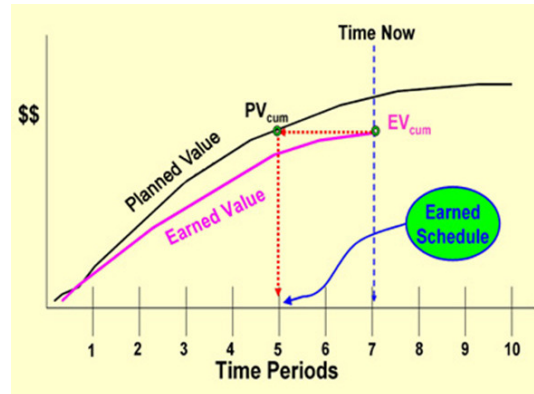


Interfacing Risk & Earned Value Management
A Practical Guide produced by the UK EV-Risk working Group © 2007

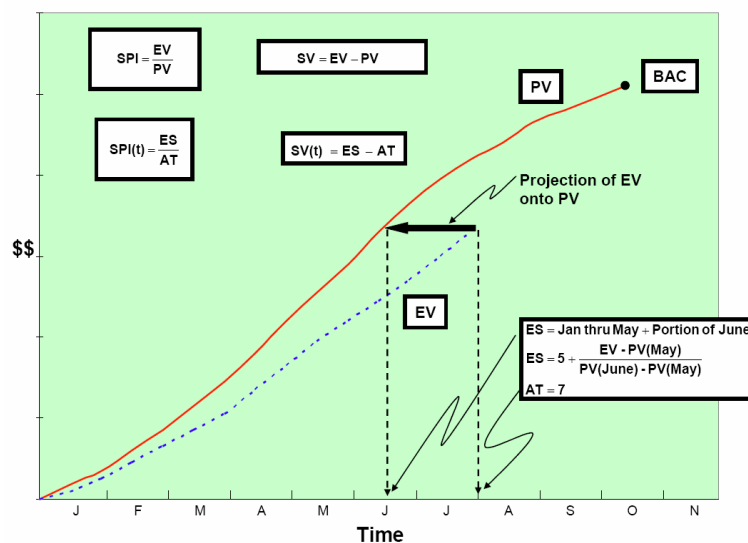
Figure 8 – Integrated Baseline Change Management Process

Earned Schedule

- Earned Schedule projects time outcomes based on performance
- As accurate as EV
- Uses the same data as EV
- Is freely available from:
<http://www.earnedschedule.com>



Earned Schedule



Conclusions

- EVM provides the framework for an effective project management and governance system
- It is flexible in the **how** of its structure and implementation (work packages)
- It is rigorous in the **what** of measurement, visibility and accountability
- **Predicts cost outcomes accurately**

Conclusions

- CPM is good for motivation and direction
 - Assumes future work will go as planned
- Monte Carlo can calculate contingencies
- Earned Schedule can predict likely schedule outcomes based on performance
 - But cannot be used as a 'control' tool

Conclusions

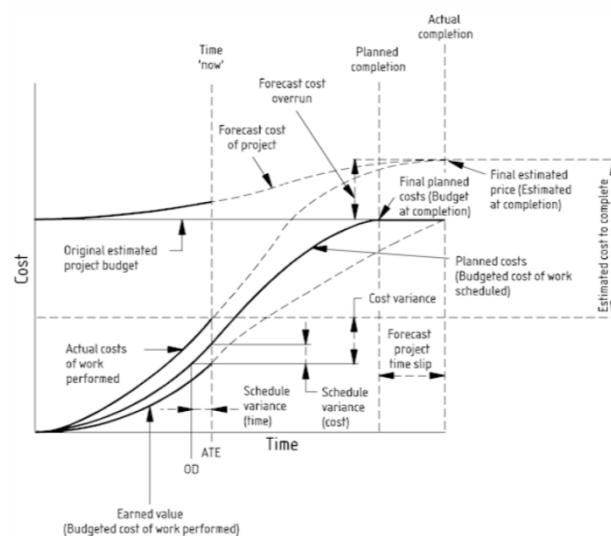
- All four are needed for a full understanding of the current situation
 - Monte Carlo to understand uncertainty
 - CPM to direct and plan use of resources
 - EV (cost) to predict and manage cost outcomes
 - ES to predict time outcomes

See: Why CPM is wildly optimistic -

http://www.mosaicprojects.com.au/Resources_Papers_117.html

Conclusions

- The complete picture is needed for effective governance and control





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◦ **Better Management** ◦ **Better Projects**

Earned Value Management



Questions??



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An Overview of Earned Value Management

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