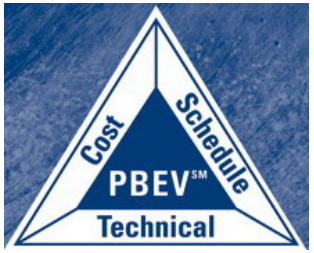
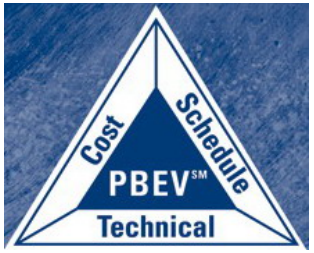


Agile Methods with Performance-Based Earned Value

CMMI® Technology Conference
Abstract 7110
November 20, 2008

Paul Solomon, PMP
Performance-Based Earned Value®
www.PB-EV.com



Agenda

- Customer expects valid Earned Value (EV)
- Agile methods and EV
- CMMI and Systems Engineering guidance
- Incremental functionality
- Scrum application
- Agile EV Summary

Value of Earned Value

EVM data will be reliable and accurate only if:

- **The right base measures of technical performance are selected**

  and

- **Progress is objectively assessed**

PB-EV link, *Integrating SE with EVM*, Defense AT&L Magazine, May 2004

EVM Not Working for DOD

7/07 USD AT&L Memo, *Use of EVM in the DOD*

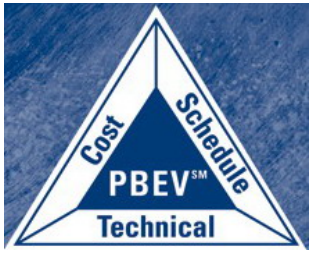
- **Use of EVM …department-wide, is *insufficient***
- **EVM is *not serving* its intended function in the internal control process**

2/08 Dept. of the Navy Memo, *EVM Reviews*

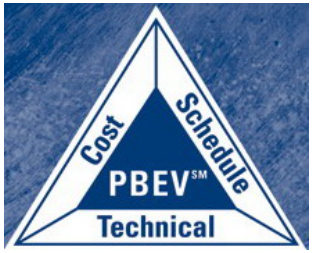
- **Broad deficiencies in EVM compliance**
  - ***Failure* to manage and document *changes to the baseline***
  - ***Lack of integration* across the cost, schedule, and work authorization systems**
  - ***Intentional masking* of cost and schedule *variances***
  - ***Inadequate reporting* of EAC**

Deficiencies in Use of EVM

GAO Report	Title	Findings and Recommendations
08-448	Defense Acquisitions: Progress Made in Fielding Missile Defense, but Program Short of Meeting Goals (Missile Defense Agency (MDA)	**Deferred Functionality** MDA *did not track* the cost of work *deferred* from one block to another. • Cost of first block understated. • Cost of second block overstated.



Agile Methods and EV



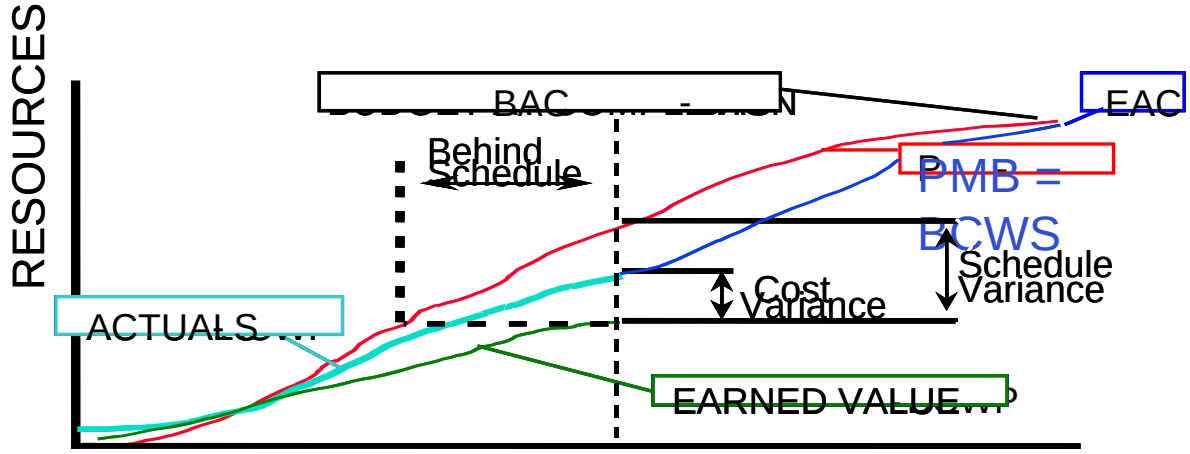
Agile Characteristics

- Next iteration of work is detail planned in work package
- Product burndown is a planning package for remaining features
- Features often deferred from the current iteration to the product burndown
- Features and priorities frequently revised

Agile and EVMS Constraints

But EVMS Guideline requires *maintaining* the Performance Measurement Baseline (PMB)

- **Time-phased scope, schedule, and associated budget through the end of the contract (a)**

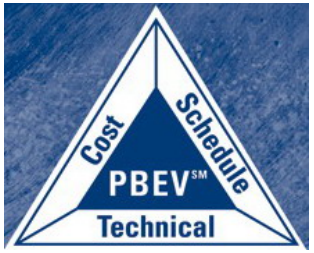


(a) National Defense Industrial Association, EVMS Intent Guideline 8

Agile Methods May Break Link with PMB

Giving full credit to meeting near term goals

- ***May break link with the PMB***
- ***Loses track of progress of plan to satisfy requirements***



CMMI and Systems Engineering Guidance Augment EVMS, Support Agile

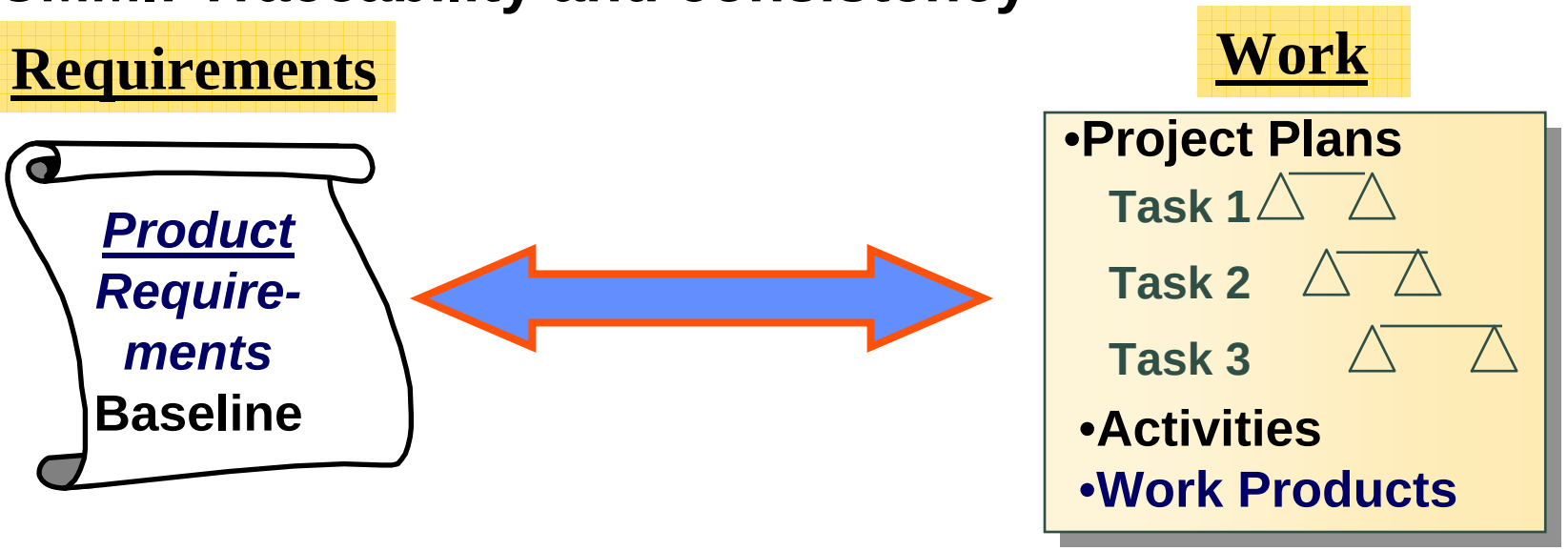
Guidelines Based on Standards and Models

- Processes for Engineering a System (ANSI/EIA-632)
- Standard for Application and Management of the SE Process (IEEE 1220)
- Capability Maturity Model Integration (CMMI®)
  - CMMI for Development, Version 1.2
  - CMMI for Acquisition, Version 1.2

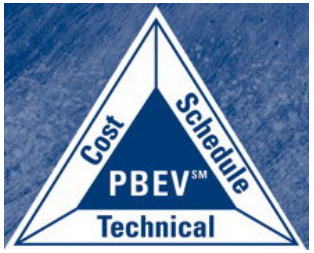
PB-EV link, *Using CMMI to Improve Earned Value Management*

CMMI: Traceability

- CMMI: Traceability and consistency



Source: CMMI Requirements Management Process Area (PA), Specific Practice (SP) 1.5



CMMI

- **CMMI Process and Product Quality Assurance PA, SP 1.2**
  - ***Objectively*** **evaluate work products against** ***clearly stated criteria***
  - ***Evaluate at selected milestones in their development***

CMMI Typical Work Products

Requirements Development PA

- ***Product requirements***
- ***Activity diagrams and use cases***

Requirements Management PA:

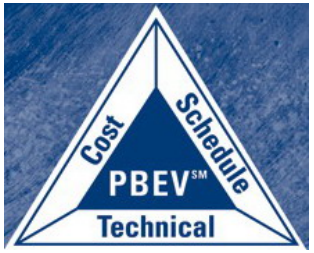
- **Requirements traceability matrix (RTM)**

Measurement and Analysis PA:

- ***Specifications of base and derived measures***

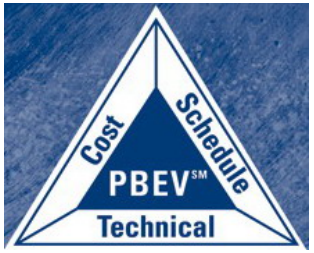
Technical Solution PA:

- ***Allocated requirements***



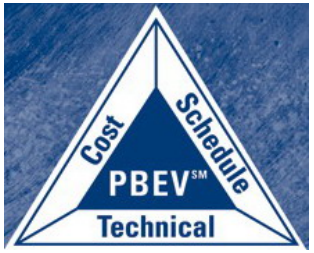
Requirements and Product Metrics

IEEE 1220	EIA-632
6.8.1.5 Performance-based progress measurement	4.2.1 Req. 10: Progress against requirements
6.8.1.5 d) Assess • *Development maturity* • Product's ability to *satisfy requirements* 6.8.6 ***Product metrics at pre-established control points:*** • Evaluate system ***quality*** • *Compare* to *planned goals and targets*	Assess *progress …* • Compare system definition *against requirements* a) Identify ***product metrics*** and *expected values* ▪ *Quality* of product ▪ Progress towards *satisfying requirements* d) *Compare* results against *requirements*



Success Criteria for Design

IEEE 1220, (6.6): Success Criteria (CDR)
• Design solution meets: – *Allocated performance requirements* – *Functional performance requirements* – Interface requirements – Use models and/or prototypes to determine success



Incremental Functionality

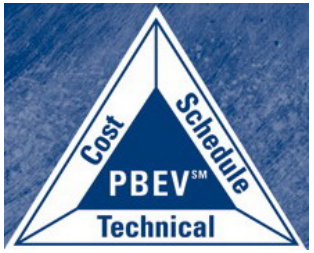
Incremental Software Capability

- Document baseline content of each build
  - # functional requirements
- Establish build milestones and completion criteria (# functional requirements)
- Establish work packages and EV metrics for builds
- Take EV based on enabling work products and functionality *achieved*
- Account for deferred functionality

PB-EV link, *PBEV Webinar,* DOD Data and Analysis Center for Software (DACS), August 2008

Internal Replanning of Deferred Functionality

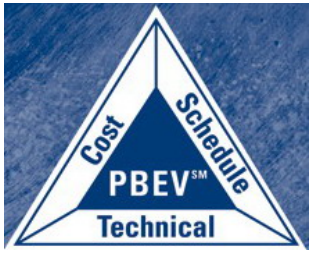
- If build is released short of planned functionality:
  - Take partial EV and leave work package open
    or
  - Take partial EV and close work package
    - Transfer deferred scope and budget to first month of work package for next incremental build
      - EV mirrors technical performance
      - Schedule variance retained
    - Disclose shortfall and slips on higher schedules



Example: Deferred Functionality

SOW: Software Requirements in 2 Builds:

Build	Allocated Req.	Budget/Req.	BAC
A	100	5	500
B	60	5	300



SW Build Plan

	Jan	Feb	Mar	Apr	May	Jun	Jul	Total
Build A								
Planned Reqs. met	25	25	25	25				100
Budget/Req.: 5 hours								
BCWS current (cur)	125	125	125	125				500
BCWS cumulative (cum)	125	250	375	500				500
Build B								
Planned Reqs. Met					20	20	20	60
BCWS cur					100	100	100	300

Deferred Functionality Status

	Jan	Feb	Mar	Apr	Total
Build A					
Planned Reqs. Met cur	25	25	25	25	100
Actual Reqs. Met cur	20	20	25	25	90
BCWS cur	125	125	125	125	500
EV cur	100	100	125	125	450
BCWS cum	125	250	375	500	
EV cum	100	200	325	450	
Schedule variance (SV):					
Reqs. Met	-5	-10	-10	-10	
SV	-25	-50	-50	-50	

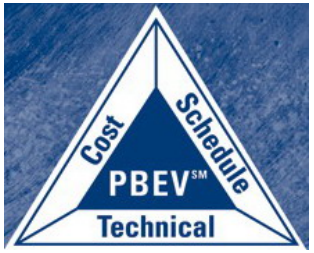
Release Build A.

Move 10 reqs to Build B.

Deferred Functionality Replan

	Apr	May	Jun	Jul	Total
Close Build A work package					
Schedule variance (cum.):					
Req Not Met	**- 10**				-10
BCWP remaining	**- 50**				-50
Build B					
Before Replan					
Planned Req Met		**20**	20	20	**60**
BCWS cur		**100**	100	100	**300**
Plus transfer budget from Build A:					
Req Not Met		**+10**			
BCWP remaining		**+50**			
After replan:					
Planned Req Met		**30**	20	20	**70**
BCWS cur		**150**	100	100	**350**

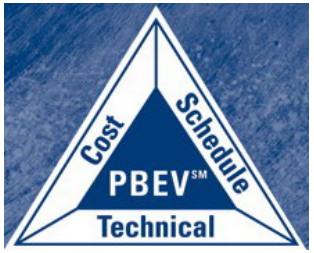
Transfer to 1st month of receiving work package to retain schedule variance



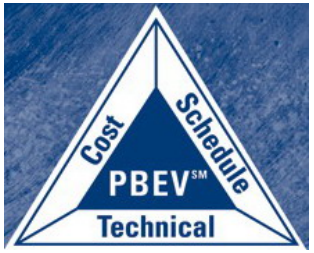
Deferred Functionality Status

	May	Jun	Jul	Total
Build B After Replan:				
Planned Reqs. Met	30	20	20	70
BCWS cur	150	100	100	350
Actual Reqs. Met cur	20			20
EV cur	100			100
Schedule variance cum:				
Reqs. Met	-10			
SV	-50			

May status: 20 reqs met, still behind schedule



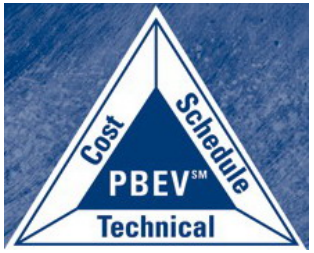
Scrum Application



Sprint Review Meeting

Replanning/EV Actions

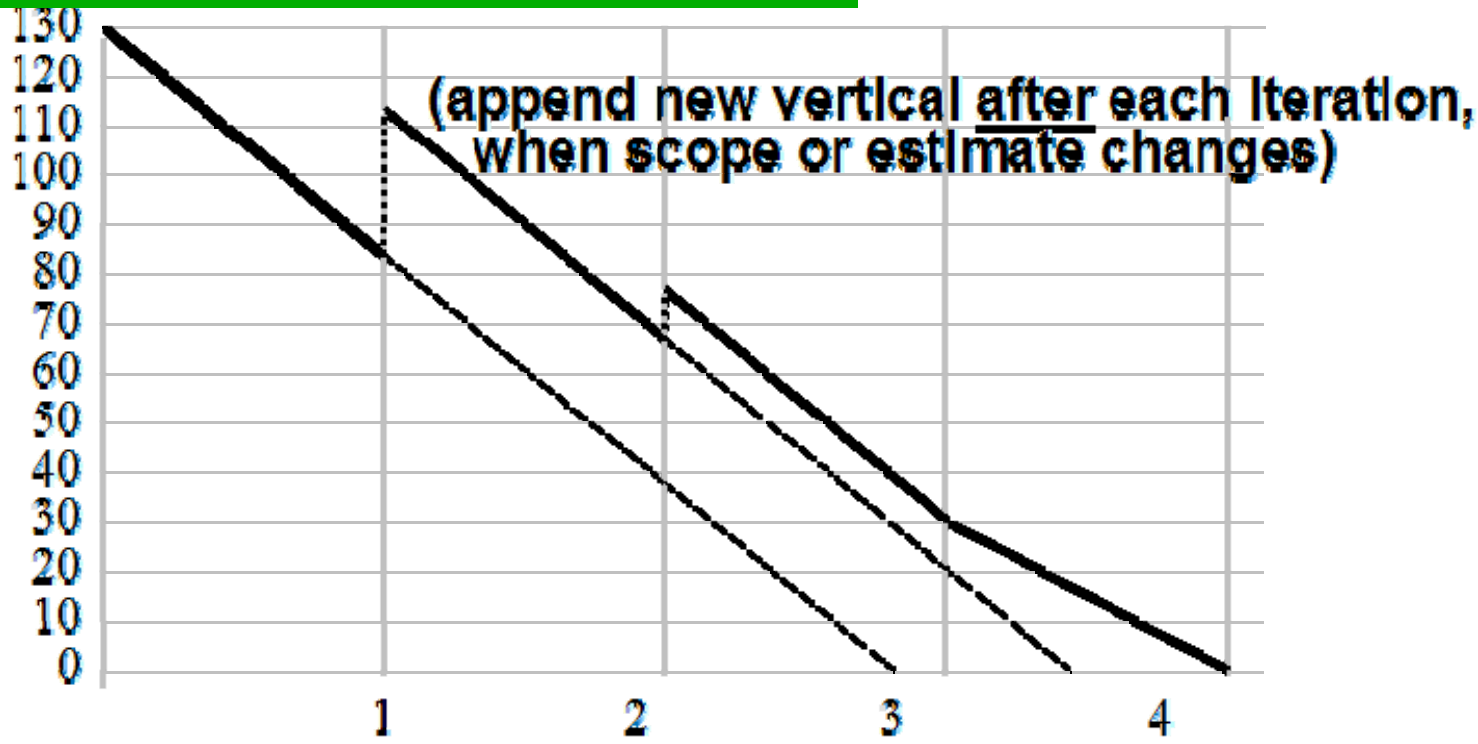
- **Agree on features that were not delivered**
- **Product Owner reviews/changes priorities of Product Breakdown Items (PBI)**
- **Better understanding of needed features**
- **Revise Estimate at Completion (EAC)**
- **Develop revised Product Backlog and burndown chart**



Burndown Chart

- How many features remain to be completed
- Captures scope change as the project progresses.
- “Features” to be developed could be story points, use cases or other nonfunctional requirements

Burndown Chart



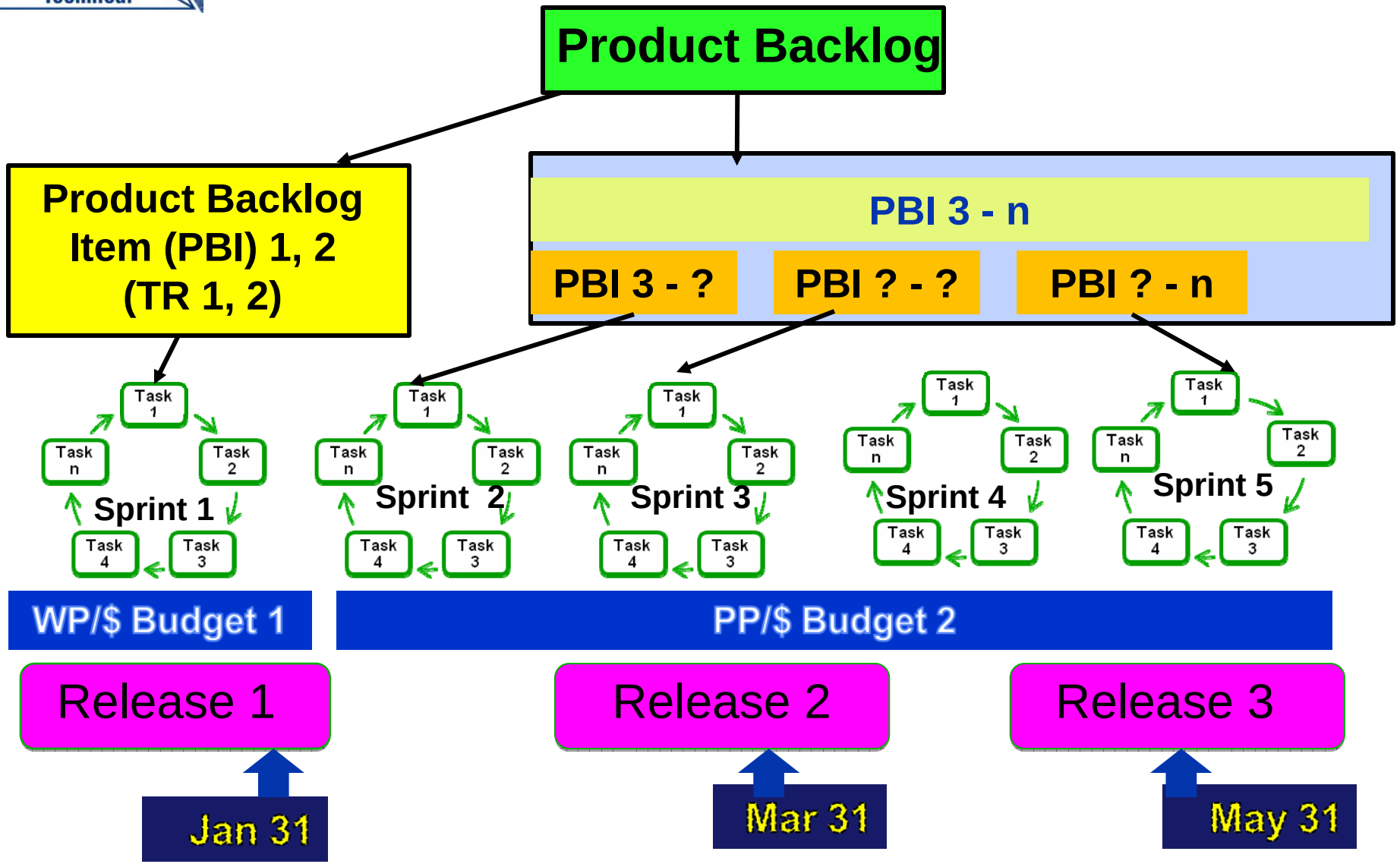
Burndown chart showing scope or estimate increase after each iteration. From A. Cockburn, *Crystal Clear*.

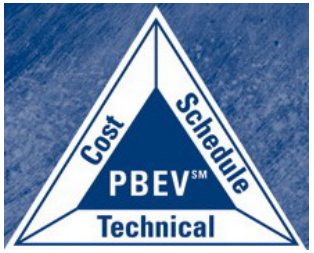
Sprint Review Meeting: EV Constraints

Budget baseline considerations

- **Most features/PBIs are derived requirements**
  - **Derived from higher level functionality**
  - **Features changes usually do not change contract scope or total budget**
- **Hold baseline finish dates of major milestones**
- **Hold cumulative Budgeted Cost of Work Scheduled (BCWS) at major milestones**
- **Maintain PMB**
  - **Deferred features**
    - **Transfer budget with SOW**
    - **Maintain schedule variance (SV)**

Agile Method

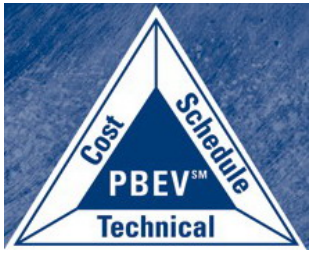




Constraints & Assumptions 1/2

Baseline Constraints/Assumptions:

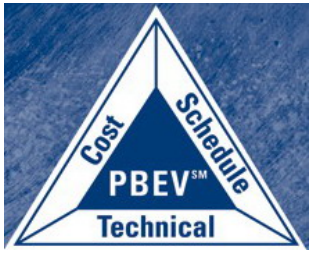
- **Set of TRs = Product Backlog Items (PBIs)**
- **Functionality/PBIs traceable to**
  - **Releases**
  - **Modules**
- **Baseline Release milestones established**
- **Budget allocated to**
  - **3 Releases (Rel)**
  - **4 Modules (Mod)**
  - **11 PBIs**



Constraints & Assumptions (2/2)

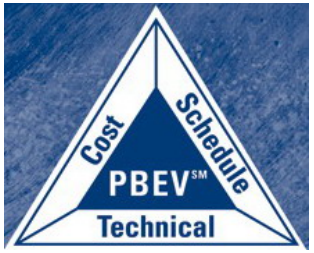
Baseline Constraints/Assumptions (continued):

- **Budget = 5,000 hours**
- **Budget based on estimated hours/PBI**
- **Each PBI has 5 features**
  - **Each feature has equal estimated hours**
- **Sprint 1 in a work package (WP)**
- **Future sprints in a planning package (PP)**
- **Period of Performance : Jan 1 – May 31**



Product Backlog

Release	Function	PBI	Priority	Function
1	Login	1	1	Validate member's pin number
	and	2	2	Withdraw Menu
	Menu	3	3	Deposit Menu
		4	4	Balance Inquiry Menu
		5	5	Access Funds in Other Banks/Credit Cards
		6	6	Transfer Between Accounts
2	Withdraw	7	7	Enter Amount
	Functions	8	8	Select Fast Pay Amount
		9	9	Select Account (Checking, Savings)
3	Deposit	10	10	Enter Amount
	Functions	11	11	Select Account (Checking, Savings)



Plan

Function/ Release	Module	PBI	Est./ PBI	Features/Month Jan	Feb	Mar	Apr	May	Total
1	1	1	200	1-5					
		2	200	1-5					
	2	3	250	1-5					
		4	150	1-5					
		5	300	1-5					
		6	100	1-5					
Total/Rel			1200						
2	3	7	500		1-5				
		8	600		1-3	4,5			
		9	900			1-5			
Total/Rel			2000						
3	4	10	800				1-5		
		11	1000				1,2	3-5	
Total/Rel			1800						
Total			5000						
BCWS/Month				1200	860	1140	1200	600	5000

Accomplishment & EV Status

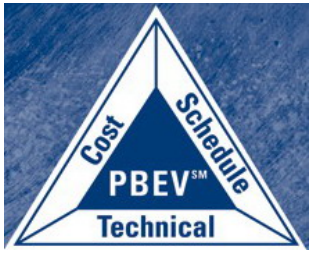
1 Determine EV and conduct Sprint Review at end of Sprint 1, Jan. 31

- **All PBIs completed except PBI #5**
- **PBI #5, Access other funds: 2 of 5 features completed**
- **Customer adds 3 new features to existing functions/backlog**
- **Customer decision on remaining features:**

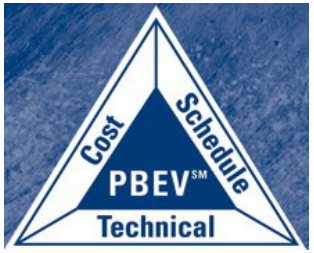
Remaining Features	Decision	EV/budget impact
1. Draw cash from other bank accounts	Defer	Behind schedule: •Transfer to backlog • Maintain SV
4. Draw cash from affiliated credit cards 5. Draw cash from other credit cards	Descope	Behind schedule: •Transfer to new features • Maintain SV

EV and Schedule Variance

Function/ Release	TR	Est./ TR	Features/Month Jan EV	Feb	Mar	Apr	May	Total
1	1-4, 6	900	900					
	5	300	300, 120 or 0?					
Total/Rel		1200						
2	7	500		500				
	8	600		360	240			
	9	900			900			
Total/Rel		2000						
3	10	800				800		
	11	1000				400	600	
Total/Rel		1800						
Total		5000						
BCWS/Month			1200	860	1140	1200	600	5000
Schedule Variance?			0, -180, -300?					



Agile EV Summary



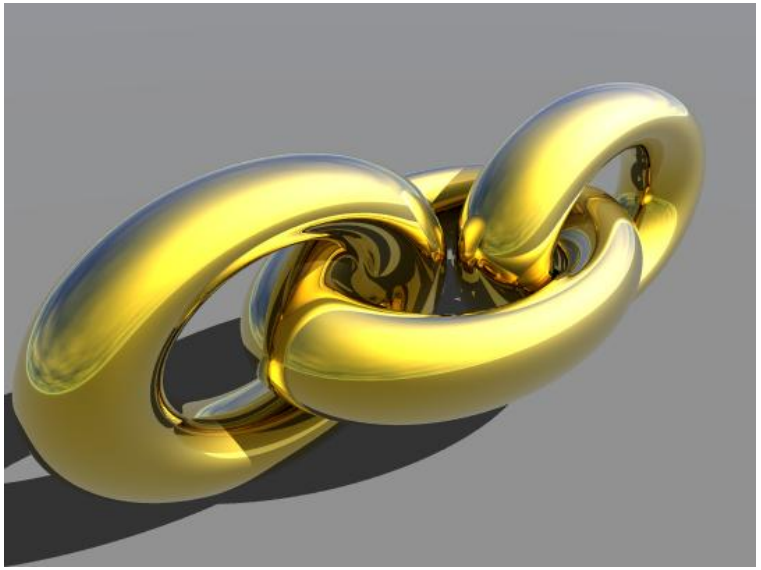
Agile EV Constraints

Internal replanning guidance:

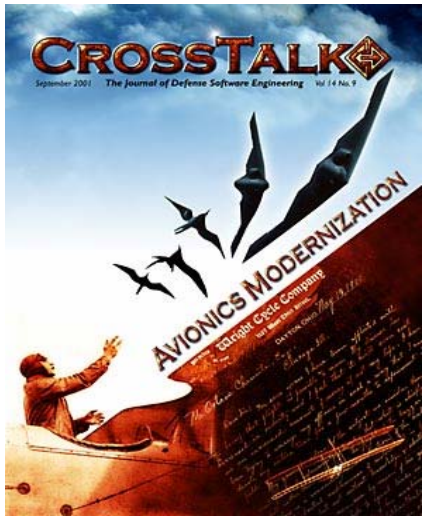
- **Hold PMB despite changes to PBI burndown**
  - **Hold baseline finish dates of major releases**
  - **Hold cumulative BCWS at major milestones**
- **Transfer budget for deferred features to first period of next iteration/sprint**
- **Reallocate budget for descoped features to PBI unless a function was also descoped**
- **Maintain reported schedule variances**
- **Reallocate remaining EV to remaining PBI tasks (including delta PBIs) after each iteration**
- **Revise EAC, compare to funding, reprioritize**

Maintain Link with PMB

- EV based on delivered features vs. plan
- Flexible planning for new priorities
- But measure progress towards meeting all requirements in the technical baseline

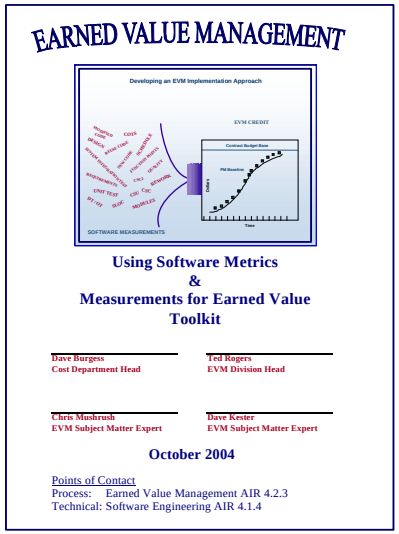


References to Performance-Based EV



DOD

SEI



NAVAIR

DOD

ICFAI U. Press, India

DoD Data & Analysis Center for Software

www.PB-EV.com