



College of Performance Management

EVM World 2013 Conference

# AgileES *Earned Schedule for Agile Projects*

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# Context

Over the past decade, Earned Schedule has been elaborated, empirically verified, and adopted by diverse industries. During the same period, Agile methodologies have become widely used, especially in engineering and technology projects.

AgileES combines the two innovations by

- ...Proving the mathematical correlation between Earned Schedule and Agile metrics
- ...Validating AgileES metrics on actual projects
- ...Identifying and unraveling lessons learned.

## Agenda

- Opening Thoughts
- Context
- Definitions
- Agile Metrics
- Earned Schedule Metrics
- AgileES Duration Metrics
- Mathematical Correlation
- Proof Structure
- Mathematical Moments
- Experimental Results
- Preparation
- Project A
- Project B
- Lessons Learned
- Objections
- Usefulness
- Challenges
- Closing Thoughts
- Summary

# Agile Metrics

Sprint

Basic unit of Agile delivery, usually 1-4 weeks

Release

A set of sprints

Release Points

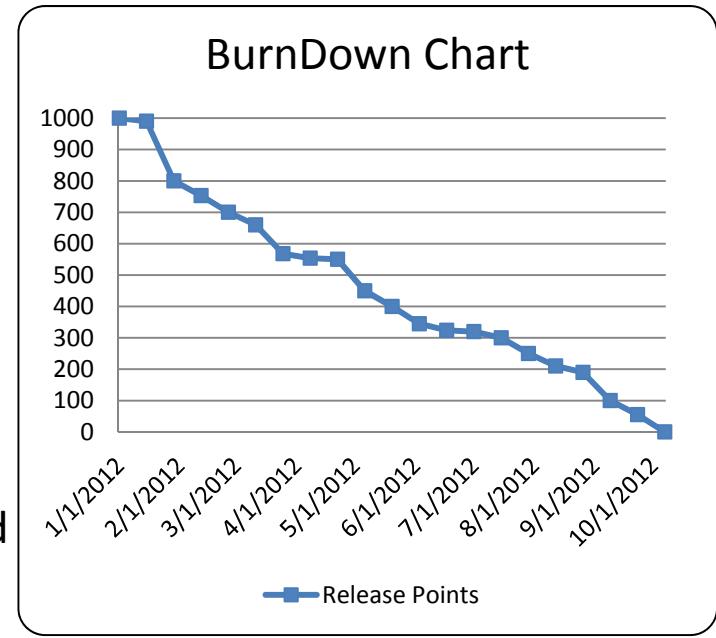
Relative measure of what is or is to be delivered

Velocity

Planned productivity per sprint

Key Equation

$$RD = SD + L \times \left( n \times \frac{1}{\% \text{ Complete}} \right)$$



*RD = Release Date  
SD = Start Date  
L = Length  
n = Sprint number*

# Earned Schedule Metrics

### Earned Schedule (*ES*)

“The amount of time earned on a project is the time at which the value currently earned should have been earned.”

- Walt Lipke

### Schedule Performance Index for time (*SPI<sub>t</sub>*)

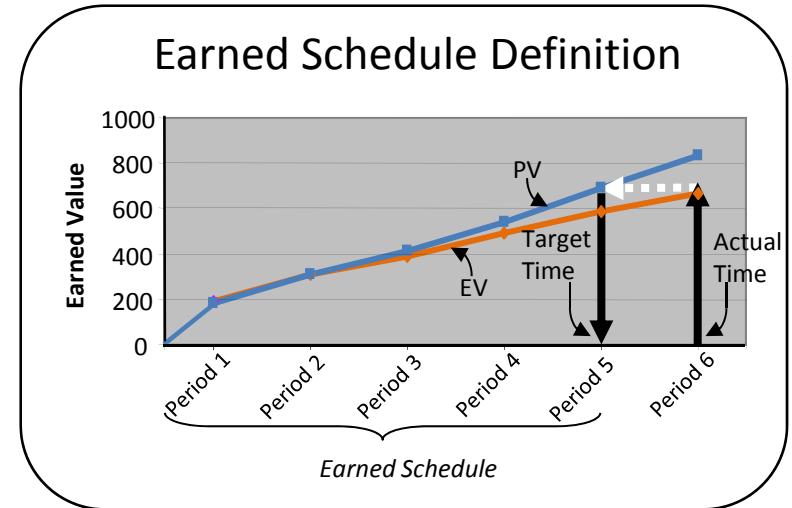
Measure of schedule performance efficiency

### Estimate At Completion for time (*EAC<sub>t</sub>*)

Estimated duration given schedule performance efficiency

### Key Equation

$$ES = \sum_{i=1}^j (EV_{AT} \geq PV_i) + \frac{EV_{AT} - PV_i}{PV_{i+1} - PV_i}$$



*EV* = Earned Value  
*PV* = Planned Value  
*AT* = Actual Time  
*i, j* = Time Periods

# AgileES Duration Metrics

Planned Duration for Velocity ( $PD_v$ )

Length of time planned for producing all release points at planned velocity

Earned Duration for Velocity ( $ED_v$ )

Length of time required for producing all completed release points at planned velocity

Earned Duration for Earned Schedule ( $ED_{ES}$ )

Length of time required to accumulate planned release points up to and including amount of release points completed

Key Equations

$$PD_v = L \times \left( \frac{PRP_n}{PV_n} \right)$$

$$ED_v = L \times \left( \frac{RPC_n}{PV_n} \right)$$

$$ED_{ES} = L \times \left( \sum_{n=1}^N (RPC_{AT} \geq CPRP_n) + \frac{RPC_{AT} - CPRP_n}{CPRP_{n+1} - CPRP_n} \right)$$

$L$	= Length
$PRP$	= Planned Release Points
$RPC$	= Release Points Completed
$PV$	= Planned Velocity
$CPRP$	= Cumulative PRP
$AT$	= Actual Time
$n, N$	= Sprint Number

# Proof Structure

To prove the correlation between Agile metrics and AgileES metrics, derive the AgileES release date equation from the Agile release date equation.

Start with Agile release date equation.

$$RD = SD + L \times \left( n \times \frac{1}{\% \text{ Complete}} \right)$$

Substitute for the performance term.

$$RD = SD + L \times \left( n \times \frac{PD_v}{ED_v} \right)$$

Substitute for the Agile velocity terms.

$$RD = SD + L \times \left( n \times \frac{PD_{ES}}{ES} \right)$$

Derive the AgileES equation.

$$RD = ?$$

$PD_v$  = Planned Duration for velocity  
 $ED_v$  = Earned Duration for velocity  
 $PD_{ES}$  = Planned Duration for Earned Schedule

# Mathematical Moments

1. Transform  $\frac{1}{\% \text{ Complete}}$  into  $\frac{PD_v}{ED_v}$ .

For Agile,  $\% \text{ Complete}$  is the ratio between the total release points that have been completed and the total release points that have been planned. That ratio is the same as the ratio between the planned duration and the earned duration. Thus,

$$\frac{1}{\% \text{ Complete}} = \frac{PRP_n}{RPC_n} = \frac{PD_v}{ED_v}$$

2. Transform  $\frac{PD_v}{ED_v}$  into  $\frac{PD_{ES}}{ED_{ES}}$ .

For both  $PD_v$  and  $PD_{ES}$ , the planned duration is the difference between the Finish Date and the Start Date. Thus,

$$PD_v = PD_{ES}$$

*Continued...*

# Mathematical Moments

2. Transform  $\frac{PD_v}{ED_v}$  into  $\frac{PD_{ES}}{ED_{ES}}$ .

$ED_v$  and  $ED_{ES}$  are simply different ways to count the number of units of planned velocity in the release points completed.

Sprint	1	2	3	4	5	AT	Equation	ED
$RPC_{AT}$	0	15	35	40	50	-	$\frac{RPC_{AT}}{PV_n}$	5
$PV_n$	10	10	10	10	10	10		
$CPRP_n$	10	20	30	40	50	60	$\sum_n^N RPC_{AT} \geq CPRP_n$	5
$RPC_{AT}$	50	50	50	50	50	50		

What if there is a fractional amount? The total number of release points completed is the same for both  $ED_v$  and  $ED_{ES}$ . The number of release points completed at any sprint boundary is also the same. Fractional amounts, therefore, must be the same.

Thus,

$$ED_v = ED_{ES}$$

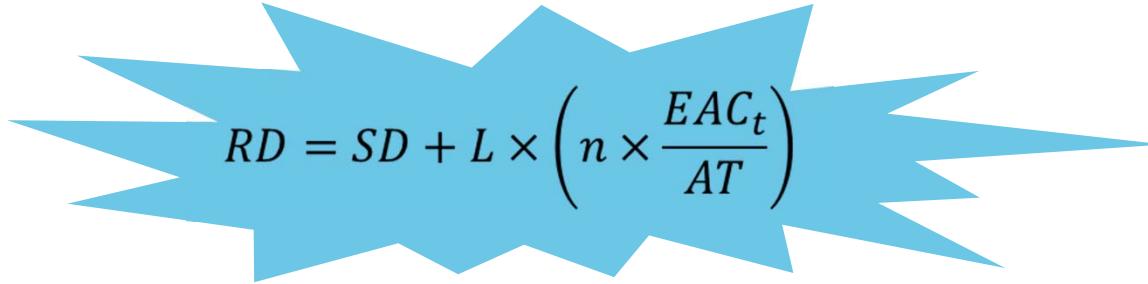
# Mathematical Moments

3. Transform  $\frac{PD_{ES}}{ED_{ES}}$  into  $\frac{PD_{ES}}{ES}$ .

The measures for sizing Agile work can be any numerical value. We can, without loss, substitute *costed* release points for release points. By multiplying all release points by a rate ( $R$ ), we preserve the relationships stated thus far, and we complete the transition from metrics based on velocity to metrics based on Earned Schedule. Thus,

$$ED_{ES} = ES$$

4. Transform  $\frac{PD_{ES}}{ES}$  into the AgileES performance term.


$$RD = SD + L \times \left( n \times \frac{EAC_t}{AT} \right)$$

*The AgileES release date equation correlates with the Agile release date equation. The correlation establishes the validity of using Earned Schedule within the Agile framework and provides the basis for practical application.*

# Experiment Preparation

To validate the mathematics, the AgileES equation was implemented in 2 Agile projects.

Project A is a typical Agile (Scrum) project: system development, experienced team.

Project B is atypical: a business project, an inexperienced team.

Both projects prepared a product backlog, a relative sizing, and a release plan.

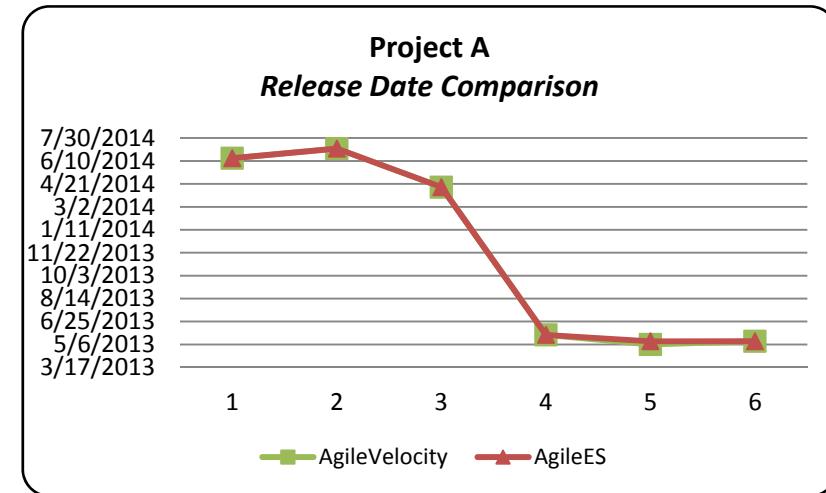
A spreadsheet was used to collect standard Agile data and perform AgileES calculations.

Start Date	1/14/2013	Baseline 1		Baseline 2			
Sprint Length	2 weeks						
Actual cost	\$200,000						
Sprint	1	2	3	1	2	8	Base2 Tot
Planned Release Points	88	80	168	424	848	456	5496
Release Pts Completed	88	80	128	424	848	0	1928
% Complete	0.03	0.05	0.08	0.08	0.23	0.35	0.35
Earned Value	8,800.00	8,000.00	16,800.00	42,400.00	123,200.00		188,800.00
Earned Schedule	2.75						
SPI <sub>t</sub>	0.92						
EAC <sub>t</sub>	8.73						
EAC <sub>t</sub> /AT	2.91						
Release Date	5/13/2013						

# Project A Test Results

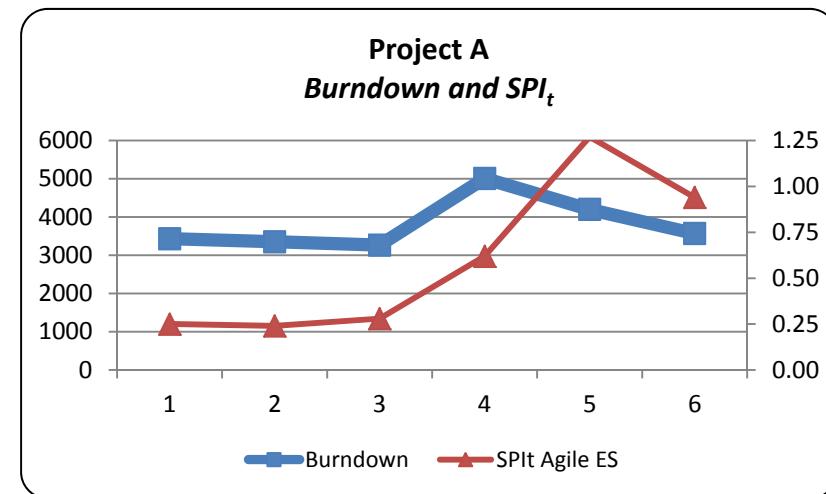
### Observations

- AgileES date estimates tracked Agile estimates
- Staff shortfall caused early low velocity
- Re-baseline required at end of Sprint 3
  - Estimated date over a year late
  - Large number of Release Points added
- Consequences of re-baselining
  - Release Date better aligned with target
  - New sprint added



### Vital Statistics

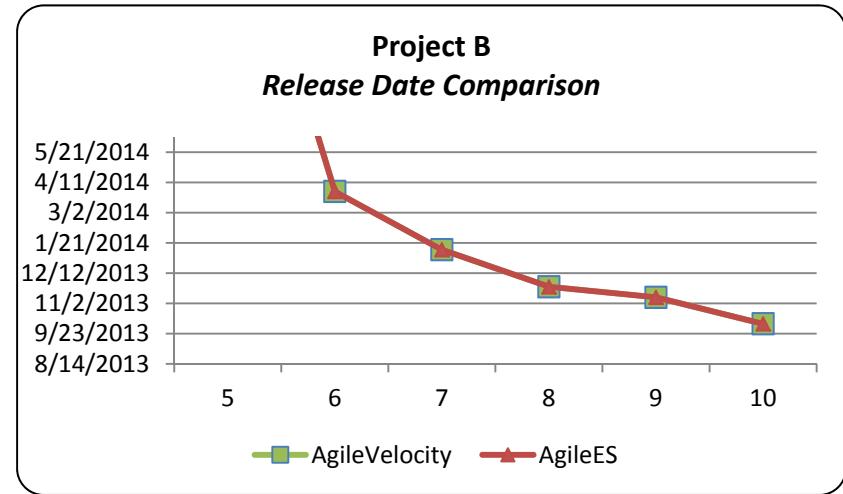
Target:	April 30	Size:	\$840K
Staff:	Experienced	Environment:	Stable
Location:	Local	Team:	6-10
Plans:	Documented	Reporting:	Formal
Length:	2 wk/sprint	# Sprints:	10+1



# Project B Test Results

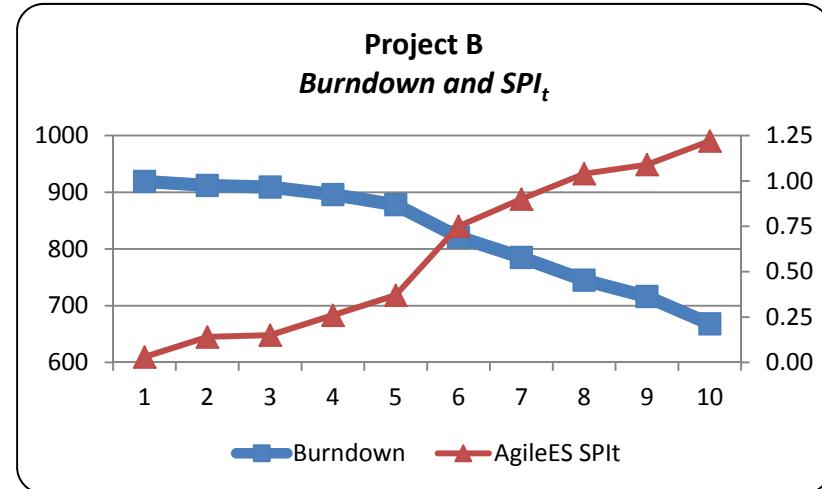
### Observations

- AgileES date estimates tracked Agile estimates
- Inexperience caused early low velocity
- Sharp productivity improvement
  - Accelerated learning curve
  - Counting methodology
- Re-baseline required at sprint 11
  - Productivity above plan
  - Early release date
  - Increased staff level



### Vital Statistics

Date:	Nov 30	Size:	\$1.4 MM
Staff:	Inexperienced	Environment:	Stable
Location:	Distributed	Team:	15-20
Plans:	Documented	Reporting:	Formal
Length:	1 wk/sprint	# Sprints:	49



# Objections

### Agile and EVM Clash

“Artificial measures such as EVM typically prove to be overhead at best, whose only value is to cater to the dysfunctional bureaucrats infesting many organizations.”

- Scott Ambler

“Even if you get the EVM numbers, is it not more important to actually produce ‘useful deliverables’?”

- J. F. G.



### Response

AgileES and Agile are mathematically correlated—the math can be ignored, but it cannot be denied.

Bogus dichotomy—getting the numbers does not inhibit delivery.

# Objections

### High Ceremony

"EVM is incredibly attractive to managers desperate to make it appear that their team is making progress even though actual progress is questionable at best. This is particularly true of traditional teams who invest a lot of effort creating specifications, creating detailed plans, writing lots of supporting documentation, reviewing various artifacts, and making big promises that they'll eventually get around to producing actual business value when they eventually finish up all the paperwork."

- Scott Ambler

Low Ceremony Practices	
Required	Optional
Product Backlog	Atomic WBS
Relative Sizing	Absolute Sizing
Release Plan	Fixed Assignments
Actual Costs	Detailed Dependencies
	Time Carding
	Gantt Chart

### Response

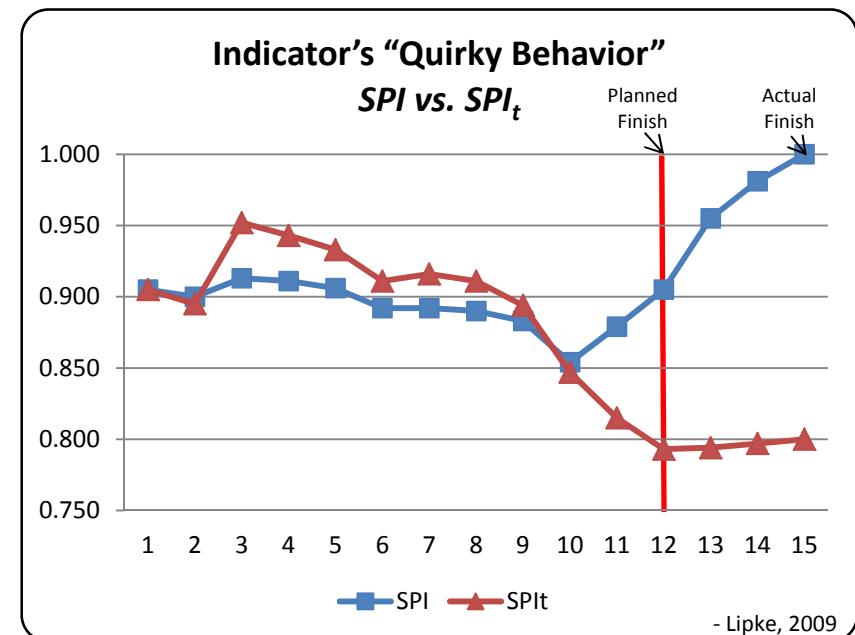
AgileES is a Low Ceremony technique—it leverages data that is typically collected on Agile projects.

# Usefulness

### Schedule Performance Index

"The schedule indicator [SPI] initially appears to establish a trend but eventually begins moving toward its end result, an index value equal to unity. This quirky behavior occurs without fail for every project finishing late...no matter how late. How do you explain that the project is estimated to deliver late,...when the schedule trend indicates the project is recovering and appears headed for an on-time completion?"

- Walt Lipke



### Solution

$SPI_t$  corrects this problem, and the correlation between AgileES and Agile justifies the use of the metric on Agile projects.

# Usefulness

### Abilene Paradox

"There are several potential factors that can negatively affect the efficacy of decision making by Agile teams. [Such] empowered, cohesive teams can exhibit problems such as the Abilene Paradox."

"The Abilene Paradox is a form of collective decision making where a group decides on a course of action that no single member would have taken on their own."

- John McAvoy and Tom Butler

Symptoms	
Private	Public
Preferences known	Silence
Solutions formulated	Silence
Reservations felt	Silence
Contrary conclusion	Collective decision

Dysfunction

### Solution

Appoint a devil's advocate to challenge group assumptions. Downside: the devil's advocate role undermines cohesion.

Provide an objective, quantitative view of project performance. Upside: a depersonalized view reduces the negative consequences for the team.

# Challenges

### AgileES Re-baseline Principles

Change is inevitable, rapid change is likely.

Frequent re-baselining is the norm.

New baseline, new project.

### Re-baseline Required?

No: Shuffling, Elaboration

Yes: Addition, Subtraction

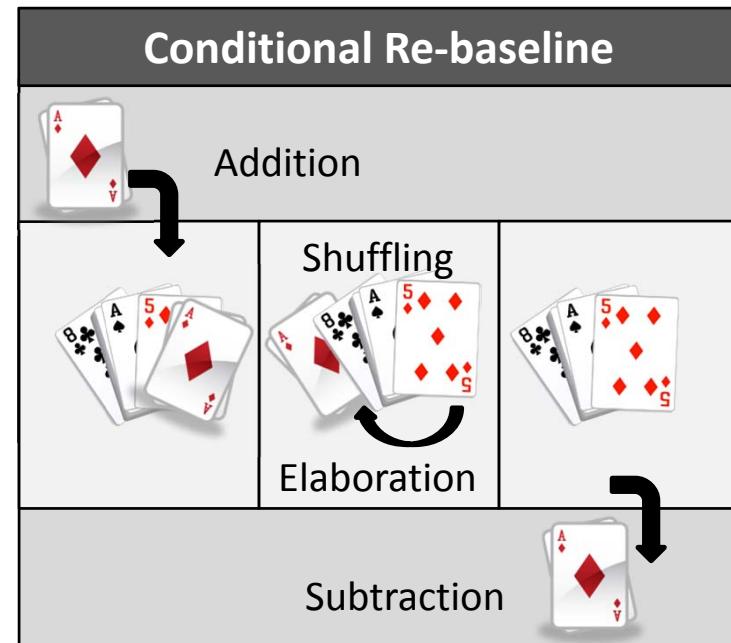
### Re-baseline How-to

Freeze completed sprints: Planned Release Points,  
Completed Release Points, Planned Value, Earned Value

Unfinished Points added to new sprint(s): all remaining Planned Release Points, partially  
Completed Release Points

Re-set sprint number and total number of sprints

Re-calculate Release Date



# Summary

- ✓ AgileES defines a set of Earned Schedule calculations using Agile metrics.
- ✓ AgileES demonstrates a mathematical relationship between Agile metrics and Earned Schedule metrics.
- ✓ AgileES metrics work on actual projects.
- ✓ AgileES “lessons learned” are identified and their implications are understood.
- ✓ AgileES proves that Earned Schedule is valid for use on Agile projects.

