A photograph of the Lincoln Memorial in Washington, D.C., taken at night. The memorial is brightly lit with warm yellow lights, and its reflection is clearly visible in the dark water of the reflecting pool in the foreground. The sky is a deep twilight blue, and some city lights are visible in the background.

**2016 Earned Value Management Practitioners (EVMP) Training  
and Symposium in Partnership with FPS**

# Agile & EVM: A Lean Approach to Implementing EVM on Agile Projects

## Project Execution & Performance Analysis

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**Date: July 27, 2016**

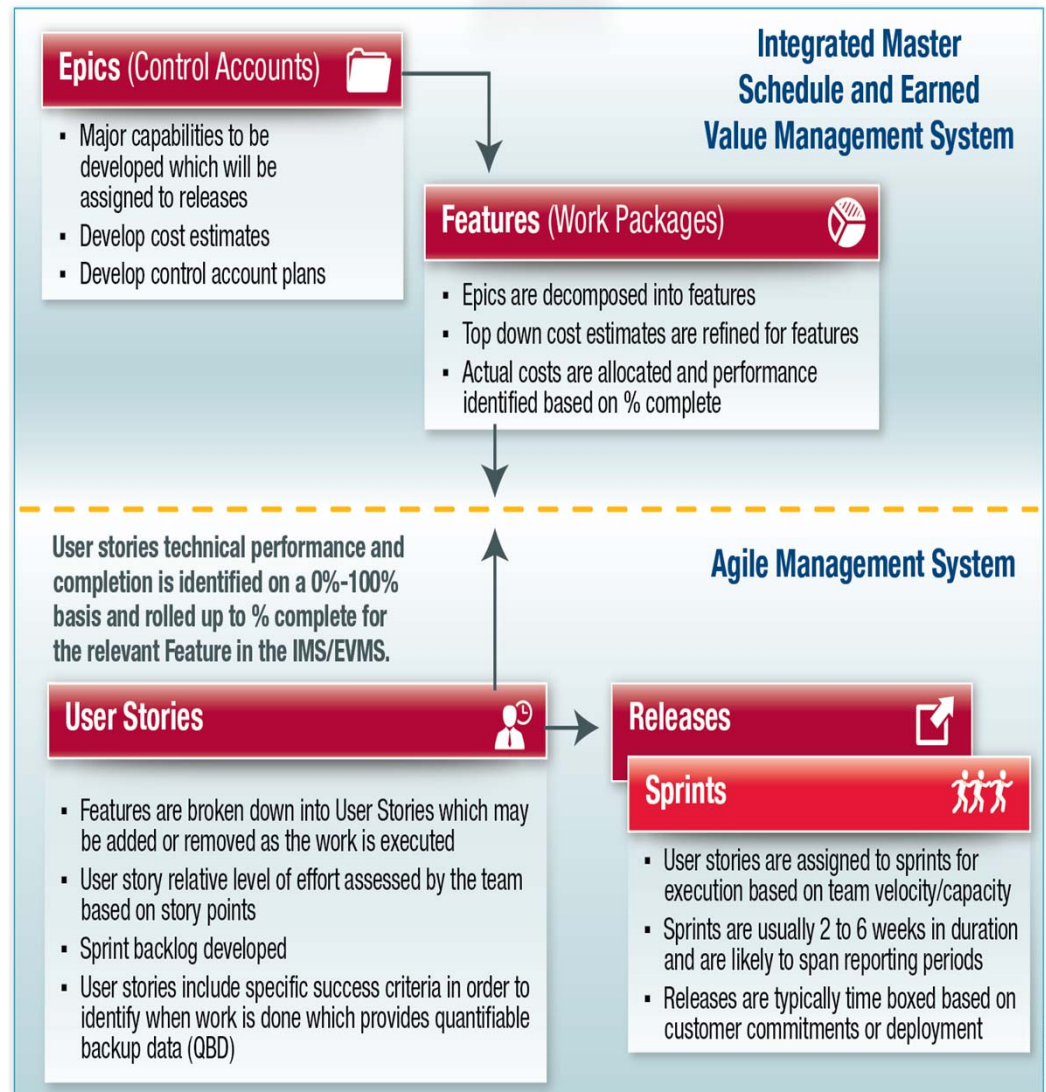
# Learning Objectives

## Project Execution & Performance Analysis

- Learn how User Stories are developed and the Product Backlog is managed
- Learn how Sprints are planned and how the Sprint backlog is developed
- Learn how technical performance is measured and EVM is applied
- Learn how independent estimates at completion (IEAC) are calculated
- Understand how corrective actions are developed

# System Overview

- IMS ends at Features
- Agile tool stores the quantifiable back up data
- EVT for WP = % Complete based on Story 0:100



# Organizing

- Work Breakdown Structure / Scope Hierarchy
  - Epics > (Capabilities) > Themes/Features > Stories  
(consistent with MIL-STD-881C)

SCOPE	DESCRIPTION	SPRINTS	RELEASES
• Epic	The largest piece of scope that comprises related features forming a complete workflow.	Many	Many
• Feature	A collection of stories that are related in some way, typically through a common user or workflow.	Multiple	No more than 1
• Story	A self-contained piece of work and the smallest decomposition of scope. Stories may be added, changed or deleted as scope is defined.	No more than 1	No more than 1

16-000-065

# Product Backlog Management

- Decompose EPIC's into Features
- Features into User Stories as required to support Sprints
- Maintain a mix of sizes of user stories – some large some small
- Include Product Backlog Grooming meeting in each Sprint
- User Stories may include:
  - Features
  - Integration
  - Security
  - Other Technical (database etc..)
  - Bugs
  - Knowledge acquisition

# 1<sup>st</sup> - User Story Development

- Start with team brainstorming as many user stories as possible, don't worry about the details or classifying
- “As a \_\_\_\_\_, I \_\_\_\_\_, so that \_\_\_\_\_.”
  - As a site member, I want to describe myself on my own page in a semi-structured way. That is, I can fill in predefined fields, but also have room for a free-text field or two. (It would be nice to let this free text be HTML or similar.)
  - As a site member, I can fill out an application to become a Practitioner.
  - As a Practitioner, I want my profile page to include additional details about me
  - As a site member, I can fill out an application to become a Trainer.
  - As a Trainer, I want my profile page to include additional details about me

## 2<sup>nd</sup> – Refine User Stories

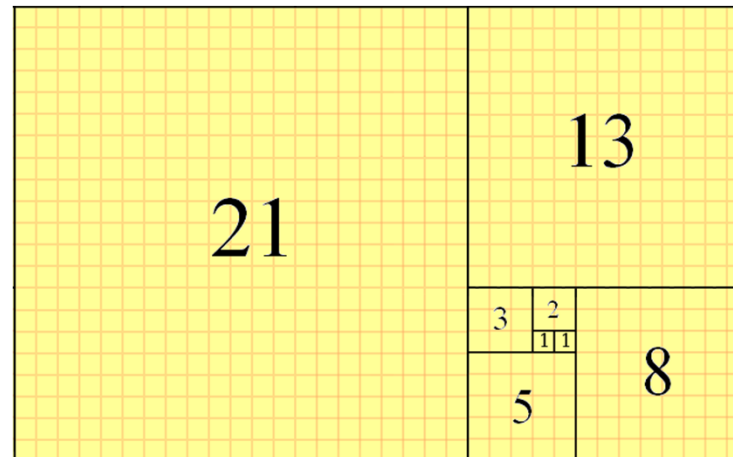
- Review list to rationalize any duplicates or identify items are too big
- Identify type and priority
- Identify acceptance criteria
- Maintain traceability to the WBS and Requirements Matrix





# 3<sup>rd</sup> – Sizing User Stories

- Purpose is to enable the development of the Sprint Backlog and to identify US's which are too big
- Size using story points as hours get confused with the level of effort and budget
- Discuss experience of members of the team addressing similar user stories
- Should represent relative complexity & level of effort to accomplish
- Use Fibonacci Numbers



- Planning poker
  - Discuss each user story and each team member throws a card with values
  - Toss out the high and low and average the remaining

# Feature - Top Down Estimate

Cobra - Time Phased Budget						
WBS	WP (Feature)	BAC	4/30/2016	5/31/2016	6/30/2016	7/31/2016
3.1.1.01	Search and return a list of results	\$ 100,877	\$ 25,219	\$ 25,219	\$ 25,219	\$ 25,219
<b>Resource Requirement</b>			\$ 25,219	\$ 25,219	\$ 25,219	\$ 25,219
	Scrum Master		\$ 7,549	\$ 7,549	\$ 7,549	\$ 7,549
	Developer		\$ 5,890	\$ 5,890	\$ 5,890	\$ 5,890
	Developer		\$ 5,890	\$ 5,890	\$ 5,890	\$ 5,890
	Developer		\$ 5,890	\$ 5,890	\$ 5,890	\$ 5,890

# Features & User Story Development

WBS	WP/Feature	Story Point Total
<b>3.1.1.01</b>	<b>Search and return a list of results</b>	<b>94</b>
US 1	Search BAR	5
US 2	Menu function	8
US 3	Search index	5
US 4	User can save search	13
US 5	Search result presentation	13
US 6	User can search by zip	8
US 7	User can search by state	8
US 8	User can search by address	13
US 9	User can search by clinic name	8
US 10	User can search by physician name	13

# Sprint Planning



# Sprints Should Facilitate Small Transfers

- Scrum teams learn to work by doing a little of everything all the time – analysis, programming, & testing
- However there will be some product backlog items that will require a week or more of programming time before the programmer can give something even beginning to be testable to a tester.
- Avoid a flurry of testing activity toward the end-of-sprint
- Instead of planning a sprint with, for example, three very large items that cannot be partially implemented, bring one or two large items into the sprint along with two or three smaller items.

# Sprint Planning

- Sprints are 4 weeks long for your team
- There will be 2 programmers 100% devoted to your project and 2 programmers who will be 50% devoted to your project
  - The 4-person Scrum team has never worked together before so we don't know what their Velocity will be
- *The Team reviews the product backlog and identifies 4 high priority User Stories with a total of 31 SP's*

# Sprint Backlog for April

User Story #	As a/an?	I want to?	So that?	Title	Type	WBS#	Acceptance Criteria	Size
US 1	User	Be able easily search the site database from home page	I can easily find information about services	Search BAR	Feature	3.1.1.01	.5 second minimum Response Tim < 1% Defects	5
US 2	User	Be able to easily search the site database from the menu	I can easily find information about services	Menu function	Feature	3.1.1.01	.5 second minimum Response Tim < 1% Defects	8
US 3	User	Get information quickly	I can make a decision about the kind of services or location of services I am interested in	Search index	Feature	3.1.1.01	.5 second minimum Response Tim < 1% Defects	5
US 4	User	Be able to save my search	So that I can return to the site to repeat my search for new information	User can save search	Feature	3.1.1.01	.5 second minimum Response Tim < 1% Defects	13
Total Story Points Sprint 1								31

# April User Story Performance

Project Scheduling Tool						
WBS	WP		4/30/2016	5/31/2016	6/30/2016	7/31/2016
3.1.1.01	Search and return a list of results		Story Point Total	Story Point Total	Story Point Total	Story Point Total
			94			
			Story Points Complete	Story Points Complete	Story Points Complete	Story Points Complete
			18			
			Story Point % Complete	Story Point % Complete	Story Point % Complete	Story Point % Complete
			19%			
-----						
Agile Management Tool						
After the 1st month the Scrum team completed the following user stories						
QBD:User Story functional test 100%, Technical performance > 90% of benchmark						
			4/30/2016	5/31/2016	6/30/2016	7/31/2016
WBS	WP/Feature	Story Point Total	Complete	Complete	Complete	Complete
3.1.1.01	Search and return a list of results	94	18			
US 1	Search BAR	5	5			
US 2	Menu function	8	8			
US 3	Search index	5	5			
US 4	User can save search	13				
US 5	Search result presentation	13				
US 6	User can search by zip	8				
US 7	User can search by state	8				
US 8	User can search by address	13				
US 9	User can search by clinic name	8				
US 10	User can search by physician name	13				

User stories completed



# Change Scenarios Exercise

- The customer and product owner identify a new feature which needs to be added to the current release during the release planning.
  - This will result in a new work package and budget. This impacts the baseline and a baseline change request should be made.
- A feature is not completed for the current release but the customer accepts delivery. The feature is still considered important and is moved to the next release.
  - This may only result in a schedule variance because the feature will be left open and finished in the next release or it may result in a baseline change. If the Feature needs to be split and the budget moved to the new release.

# Change Scenarios Exercise

- During backlog grooming meeting the team identifies an additional user story which needs to be added to a Feature which has already been started. But the new work will have to be added to a Sprint which is beyond the finish date of the work package.
  - The US is added to the product backlog and the IMS finish date slips resulting in a schedule variance and likely cost variance.
- During the sprint planning meeting the team identifies that they can combine 2 user stories?
  - This is ok as long as the Sprint hasn't started. Identify if one goes away or are they combined? Track changes in the backlog.
- During the daily standup one of the team members proposes a change to the US exit criteria which is going change the effort and SP value but it will still be completed before the baseline finish date for the feature.
  - We cannot change a US after the Sprint has started. This US should be moved to the next Sprint until the additional work and testing is completed resulting in a likely cost variance.

# Change Scenarios Exercise

- During the daily standup one of the team members suggests that a US is too large and should be split into 2 US's?
  - US should be assigned to the next Sprint and not reflected as completed in EV most likely resulting in a cost variance
- During the Sprint retrospective the team identifies an additional user story which should be added to the next Sprint for the same Feature. The Feature is forecast to be completed as originally planned.
  - Develop new user story and add to the backlog, no BCR required.

# May User Story Performance

Project Scheduling Tool						
			4/30/2016	5/31/2016	6/30/2016	7/31/2016
WBS	WP		Story Point Total	Story Point Total	Story Point Total	Story Point Total
3.1.1.01	Search and return a list of results		94	102		
			Story Points Complete	Story Points Complete	Story Points Complete	Story Points Complete
			18	39		
			Story Point % Complete	Story Point % Complete	Story Point % Complete	Story Point % Complete
			19%	38%		

User stories completed

Agile Management Tool 5/31/16  
 After the 2nd Month the Scrum team completed only 1 user story and realized they needed to add another user story  
 QBD:User Story functional test 100%, Technical performance > 90% of benchmark

WBS	WP/Feature	Story Point Total	4/30/2016 Complete	5/31/2016 Complete	6/30/2016 Complete
3.1.1.01	Search and return a list of r	94	18	21	0
US 1	Search BAR	5	5		
US 2	Menu function	8	8		
US 3	Search index	5	5		
US 4	User can save search	13		13	
US 5	Search result presentation	13			
US 6	User can search by zip	8			
US 7	User can search by state	8			
US 8	User can search by address	13			
US 9	User can search by clinic na	8			
US 10	User can search by physicia	13			
US 11	New User Story			8	

User Story added because the team realized they needed to add security

# April and May Performance

Cobra - Cumulative WP Performance				
	4/30/2016	5/31/2016	6/30/2016	7/31/2016
BAC	\$ 100,877.44	\$ 100,877.44	\$ 100,877.44	\$ 100,877.44
Planned Value	\$ 25,219.36	\$ 50,438.72	\$ 75,658.08	\$ 100,877.44
Earned Value	\$ 19,316.96	\$ 38,570.79		
Actual Costs	\$ 25,219.36	\$ 50,438.72		
Schedule Variance	\$ (5,902.40)	\$ (11,867.93)		
SPI	0.77	0.76		
Cost Variance	\$ (5,902.40)	\$ (11,867.93)		
CPI	0.77	0.76		
Remaining Work	81,560.48	62,306.65		
Independent EAC	131,701.10	131,916.65		

Added a User Story Total SP's increased

Statistical forecast over budget

# June User Story Performance

Project Scheduling Tool						
WBS	WP		4/30/2016	5/31/2016	6/30/2016	7/31/2016
3.1.1.01	Search and return a list of results		Story Point Total	Story Point Total	Story Point Total	Story Point Total
			94	102	89	
			Story Points Complete	Story Points Complete	Story Points Complete	Story Points Complete
			18	39	60	
			Story Point % Complete	Story Point % Complete	Story Point % Complete	Story Point % Complete
			19%	38%	67%	

User stories completed

Agile Management Tool						
After the 3rd Month the Scrum team completed 2 user stories and removed a user story no longer required						
QBD:User Story functional test 100%, Technical performance > 90% of benchmark						
WBS	WP/Feature	Story Point Total	4/30/2016	5/31/2016	6/30/2016	
3.1.1.01	Search and return a list of r	94	Complete	Complete	Complete	
US 1	Search BAR	5	5			
US 2	Menu function	8	8			
US 3	Search index	5	5			
US 4	User can save search	13		13		
US 5	Search result presentation	13			13	
US 6	User can search by zip	8			8	
US 7	User can search by state	8				
US 8	User can search by address	13				
US 9	User can search by clinic na	8				
US 10	User can search by physicia	13			-13	
US 11	New User Story			8		

User Story removed because they were able to include this in US 9

# June Performance

Cobra - Cumulative WP Performance				
	4/30/2016	5/31/2016	6/30/2016	7/31/2016
BAC	\$100,877.44	\$100,877.44	\$100,877.44	\$100,877.44
Planned Value	\$ 25,219.36	\$ 50,438.72	\$ 75,658.08	\$100,877.44
Earned Value	\$ 19,316.96	\$ 38,570.79	\$ 68,007.26	
Actual Costs	\$ 25,219.36	\$ 50,438.72	\$ 75,658.08	
Schedule Variance	\$ (5,902.40)	\$ (11,867.93)	\$ (7,650.82)	
SPI	0.77	0.76	0.90	
Cost Variance	\$ (5,902.40)	\$ (11,867.93)	\$ (7,650.82)	
CPI	0.77	0.76	0.90	
Remaining Work	81,560.48	62,306.65	32,870.18	
Independent EAC	131,701.10	131,916.65		

Performance improved because we completed more work & removed a user story

# Independent Estimate at Completion (IEAC) Methods

- CUMULATIVE CPI METHOD (Best Case)
  - $EAC = AC_{cum} + [(BAC - EV_{cum})/CPI_{cum}]$
- COMPOSITE METHOD (Worst Case)
  - $EAC = AC_{cum} + [(BAC - EV_{cum})/(CPI_{cum} \times SPI_{cum})]$



# Independent Estimate at Completion (IEAC) Exercise

- *What is our Best Case IEAC?*

$$\text{ETC } \$32,870.18 = [(\text{BAC } \$100,877.44 - \text{EV } \$68,007.26) / \text{CPI } 0.90]$$

$$\text{AC} = \$75,658.08$$

$$\text{IEAC} = \$75,658.08 + \$36,522.42 = \$112,180.50$$

- *What is our Worst Case IEAC?*

$$\text{ETC } \$40,580.47 = [(\text{BAC } \$100,877.44 - \text{EV } \$68,007.26) / (\text{CPI } 0.90 \times \text{SPI } .90)]$$

$$\text{AC} = \$75,658.08$$

$$\text{IEAC} = \$75,658.08 + \$40,580.47 = \$116,238.50$$

# Contractor Estimate to Complete (ETC) Exercise

- How many story points are still remaining?
  - As of June 30 we planned 89 SP's and completed 60 so there are 29 more SP's to complete
- What is the average cost of a story point since the projects inception?
  - Total Actual Costs (AC)/Total SP's Completed
  - AC as of June 30 were \$75,658.08
  - SP's Completed 60 = \$1,260.97 per SP
- What is our ETC?
  - $ETC = 29 \text{ SP's remaining to be done} \times \text{average SP Cost of } \$1,260.97 = ETC \$36,568.13$

# Contractor EAC – Most Likely

- What is the most likely EAC?
- Total Actual Costs + ETC = EAC
  - AC \$75,658.08 + ETC \$36,568.13 = EAC  
\$112,226.21

# Estimate At Completion

Project Scheduling Tool								
WBS	WP		4/30/2016	5/31/2016	6/30/2016			
3.1.1.01	Search and return a list of results		Story Point Total	Story Point Total	Story Point Total			
			94	102	89			
			Story Points Complete	Story Points Complete	Story Points Complete		Story Points Remaining	Average Story Point Cost
			18	39	60		29	\$ 1,260.97

Actual Costs/  
Story Points  
Completed

ETC	EAC	VAC
\$ 36,568.07	\$112,226.15	\$ (11,348.71)

• Variance at  
Completion

# To Complete Performance Index (TCPI) BAC

- Describes the performance required to meet BAC
- $TCPI\ EAC = [(BAC - EV) \div (BAC - AC)]$ 
  - $(BAC\ \$100,877.44 - EV\ \$68,007.26) = \$32,870.18$
  - $(BAC\ \$100,877.44 - AC\ \$75,658.08) = \$25,219.36$
  - $TCPI = 1.3$
  - So for every \$1 we spend we need to accomplish \$1.30 of work to complete the current project scope within the original budget

# What are our Alternatives?

- What's is the team velocity since project inception?
  - 60 SP's completed in 3 months = an average of 20 SP's per month
- As of June 30 we have 29 SP's to complete what is our corrective action plan to complete the project?
  - Add an additional resource? How much will this cost?
  - Add another Sprint? How much additional cost and time?
  - Discuss with the customer removing functionality from the product backlog?