



# IS EARNED VALUE + AGILE A MATCH MADE IN HEAVEN?

Presented at

*The Nexus of Agile Software Development and  
Earned Value Management, OSD-PARCA,*

February 19 – 20, 2015

Institute for Defense Analysis, Alexandria, VA

Increasing the Probability of Program Success requires connecting the dots between EV and Agile Development.



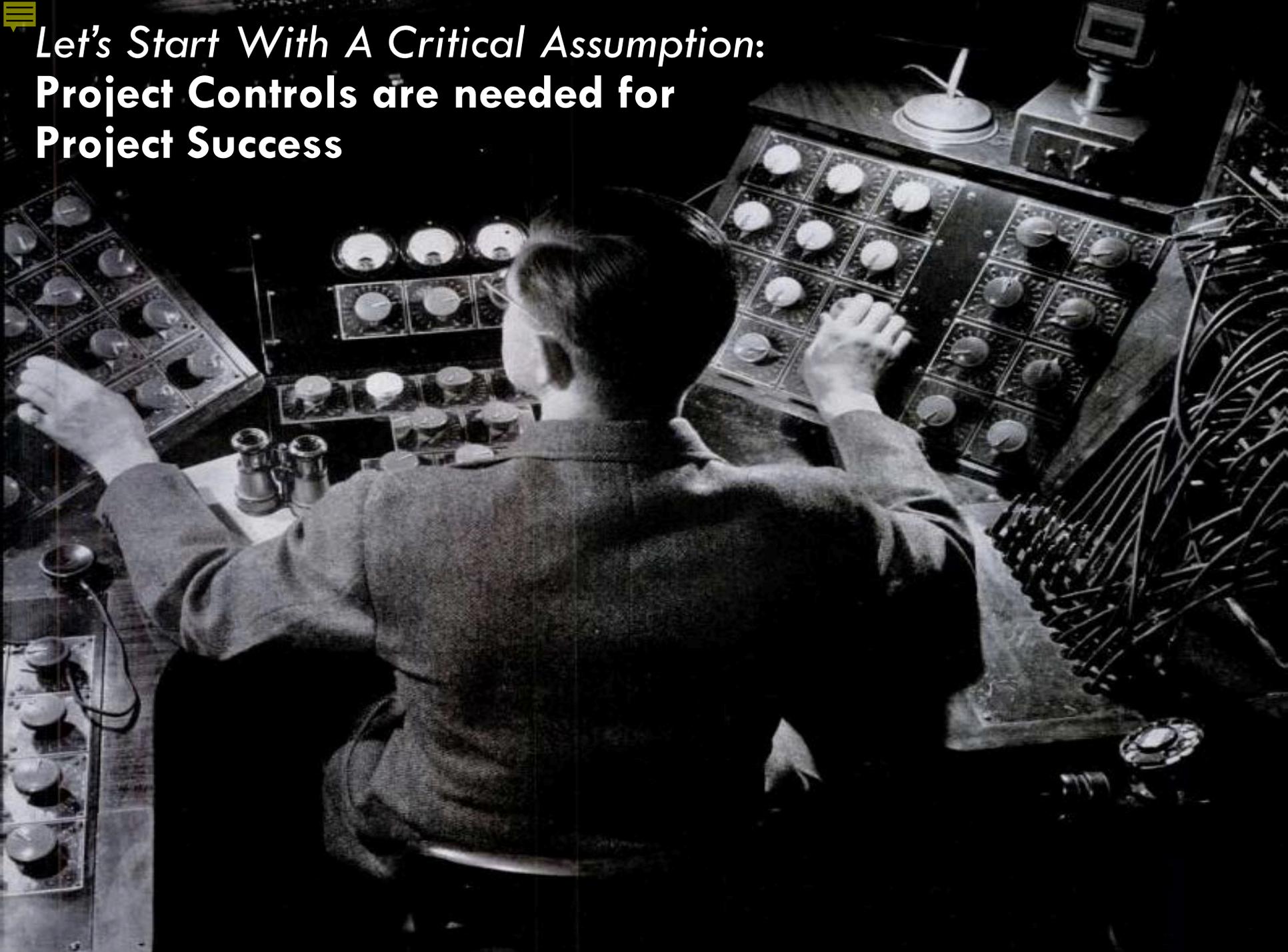
# Today's Briefing

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- How can Agile Development methods increase the Probability of Program Success (PoPS) on Earned Value programs?
- How can Agile development be integrated with the FAR / DFAR and OMB mandates for program performance measures using Earned Value?
- What are the “touch” points (or possible collision points) between Agile and EIA-748-C?
- What are the measures of success for Agile methods in the context of EIA-748-C?



*Let's Start With A Critical Assumption:*  
**Project Controls are needed for  
Project Success**





# Agile Software in the Context of the Department of Defense

The primary objective of Defense acquisition is to acquire quality products that satisfy user needs with measurable improvements to mission capability and operational support, in a timely manner, and at a fair and reasonable price.

– *Introduction to Defense Acquisition Management*,  
Defense Acquisition University, pg 1, August 2010

The value of agile methods is in the success that attends frequent, incrementally delivered features and functions, even in the swirl of complex and uncertain requirements<sup>†</sup>

**Subtitle A--Acquisition Policy and Management**

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**SEC. 804. IMPLEMENTATION OF NEW ACQUISITION PROCESS FOR INFORMATION TECHNOLOGY SYSTEMS.**

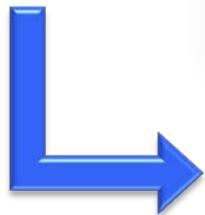
(a) *New Acquisition Process Required.*--The Secretary of Defense shall develop and implement a new acquisition process for information technology systems. The acquisition process developed and implemented pursuant to this subsection shall, to the extent determined appropriate by the Secretary--

(1) be based on the recommendations in chapter 6 of the March 2009 report of the Defense Science Board Task Force on Department of Defense Policies and Procedures for the Acquisition of Information Technology; and

(2) be designed to include--

- (A) early and continual involvement of the user;
- (B) multiple, rapidly executed increments or releases of capability;
- (C) early, successive prototyping to support an evolutionary approach; and
- (D) a modular, open-systems approach.

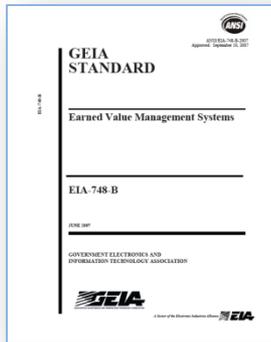
Do these  
sound  
familiar?



**They are part of the 12 principles of  
Agile Software Development**

# The Foundation For Earned Value Management ...

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- EIA-748-C, page 1, defines the top level activities for a successful EV based project.
- We need to “connect the dots” between these and agile development.

- Plan all work scope for the program from inception to completion.
- Break down the program work scope into finite pieces that can be assigned to a responsible person or organization for control of technical, schedule, and cost objectives.
- Integrate program work scope, schedule, and cost objectives into a performance measurement baseline plan against which accomplishments may be measured. Control changes to the baseline.
- Use actual costs incurred and recorded in accomplishing the work performed.
- Objectively assess accomplishments at the work performance level.
- Analyze significant variances from the plan, forecast impacts, and prepare an estimate at completion based on performance to date and work to be performed.
- Use EVMS information in the organization’s management processes.



# 12 Principles of the Agile Manifesto

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**01** Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.

**04** Business people and developers must work together daily throughout the project.

**07** Working software is the primary measure of progress.

**10** Simplicity—the art of maximizing the amount of work not done—is essential.

**02** Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

**05** Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

**08** The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

**11** The best architectures, requirements, and designs emerge from self-organizing teams.

**03** Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.

**06** Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

**09** Continuous attention to technical excellence and good design enhances agility.

**12** At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.



# What Do We Mean When We Say Agile?

“Being able to turn inside the loop of unfolding events.”<sup>†</sup>



# Is The Department of Defense Ready To Embrace Agile Methodologies?

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It seems so...

## A New Approach for Delivering Information Technology Capabilities in the Department of Defense

Report to Congress



November 2010

Office of the Secretary of Defense

Pursuant to Section 804 of the National Defense Authorization Act for Fiscal Year 2010

*Using iterative tactics to split projects into small partitions, and the second is testing in the field to improve the results of trial procedures.*

Elizabeth McGrath, Deputy Chief Management Officer And Performance Improvement Officer at the U.S. Department of Defense<sup>†</sup>

<sup>†</sup> AFCEA NOVA, January 25, 2011

# Simple Rule for Earning Value in Agile

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Each Iteration of each Release is a  
“value earning” opportunity

The next step is to connect Agile’s  
definition of Value with Earned  
Value’s definition of Value

**Business Value  $\neq$  BCWP**

# Starting to “Connect the Dots”<sup>†</sup> ‡

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<b>Agile Point of View</b>	<b>DoD Program Point of View</b>
Requirements evolve	Scope agreed to and maintained
Simple designs are best	Architecture thought out and maintained
Teams are self organizing	Organizational structure establishes boundaries
Delivery teams establish best prescriptive processes	High level guidance organizes work
Development teams know what to do	Process professionals define the boundaries
Agile team work in an iterative manner	Product Development Lifecycle is serial over broader periods of time

<sup>†</sup> Abstracted from “Reality over Rhetoric,” Scott Ambler IBM Developer Works

<sup>‡</sup> John Goodpastuer, *Project Management the Agile Way*

# Let's Start With 3 Simple Connections

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**Earned Value Management**

+

**Agile**

1

Measures of progress in units of “physical percent complete.”

Each iteration produces 100% working product.

2

Forecast of future performance provided by past performance.

Forecast performance in units of product(s) produced.

3

A systems approach to the development of products and connecting Cost, Schedule, and Technical Performance.

Increasing fidelity of product and problem understanding takes place after each iteration and release.

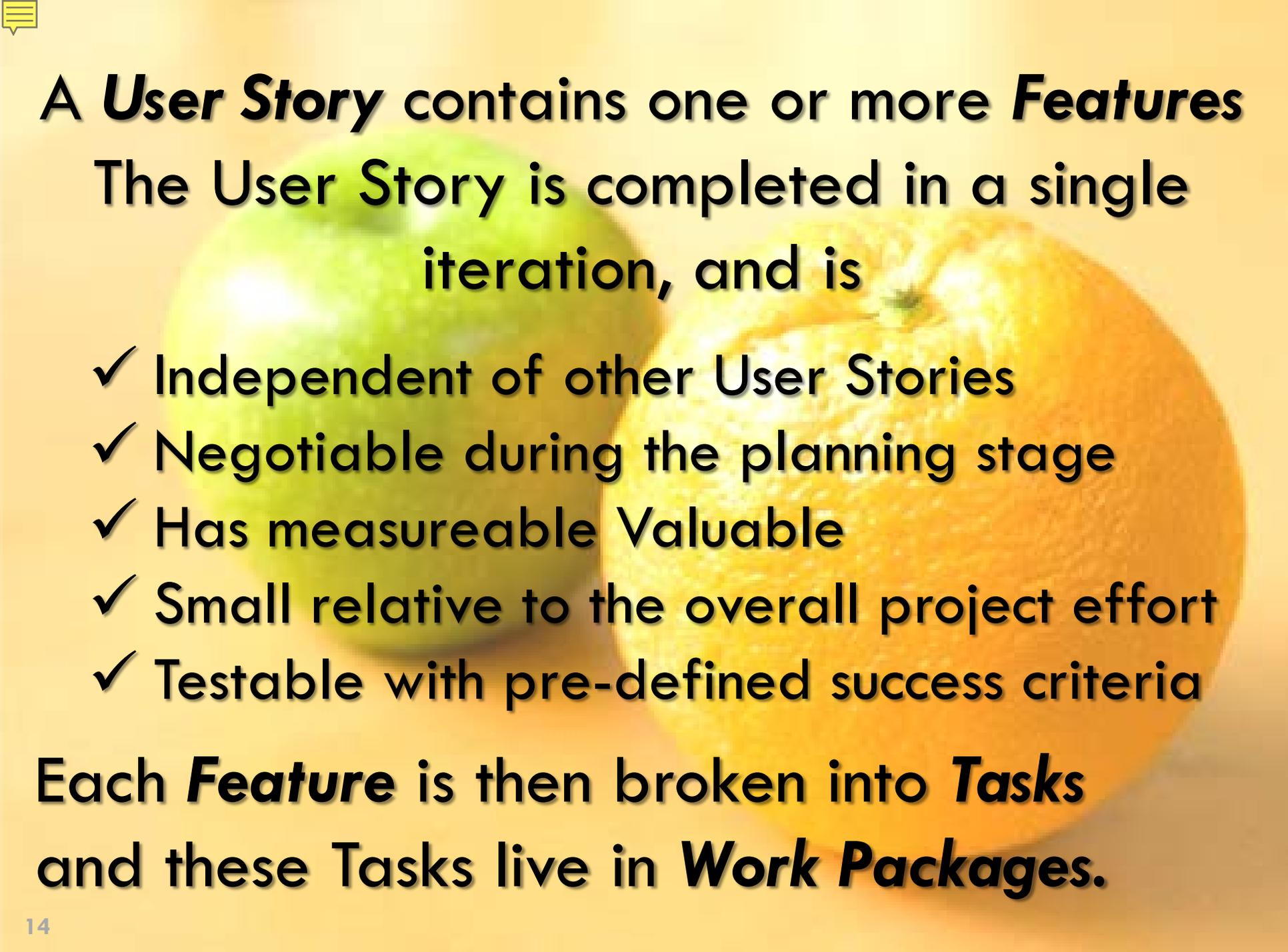
**Both EV and Agile Development Measure Progress as  
*Physical Percent Complete***

# Let's establish some terms we can use to *Connect the Dots*

***Epics are large user stories, ones too big to implement in a single iteration and need to be disaggregated into smaller user stories at some point †***



All these ***Stories*** work together inside a Project or Program to produce the needed ***Capabilities*** according to the ***Product Road Map***



A **User Story** contains one or more **Features**

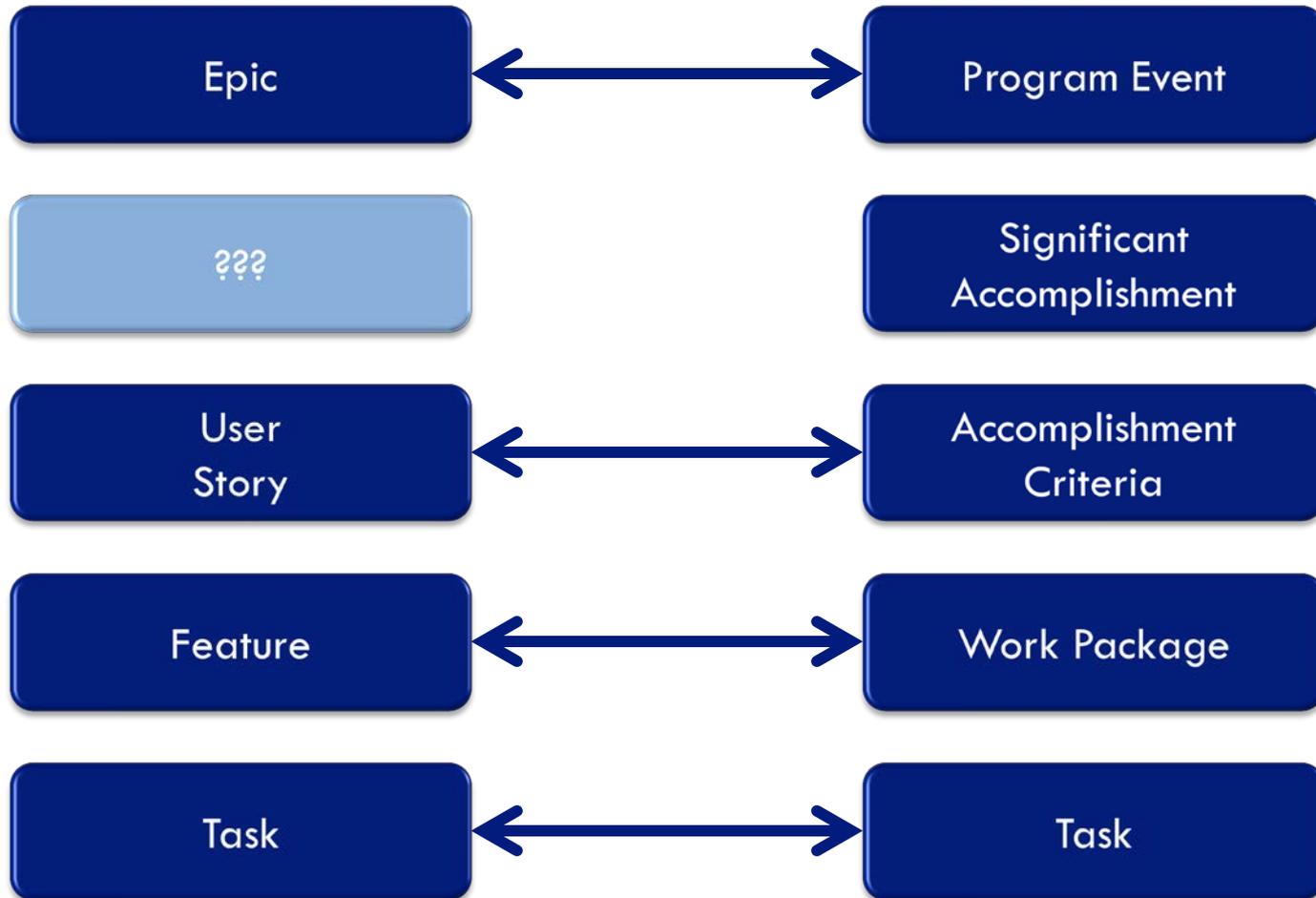
The User Story is completed in a single iteration, and is

- ✓ Independent of other User Stories
- ✓ Negotiable during the planning stage
- ✓ Has measurable Valuable
- ✓ Small relative to the overall project effort
- ✓ Testable with pre-defined success criteria

Each **Feature** is then broken into **Tasks** and these Tasks live in **Work Packages**.

# This decomposition looks very familiar!

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# Connecting *Agile* terminology with *DoD* acquisition terminology

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Define what features are needed to deliver value to the customer at the end of the release in units of measure meaningful to the customer.

Prioritized List

A

B

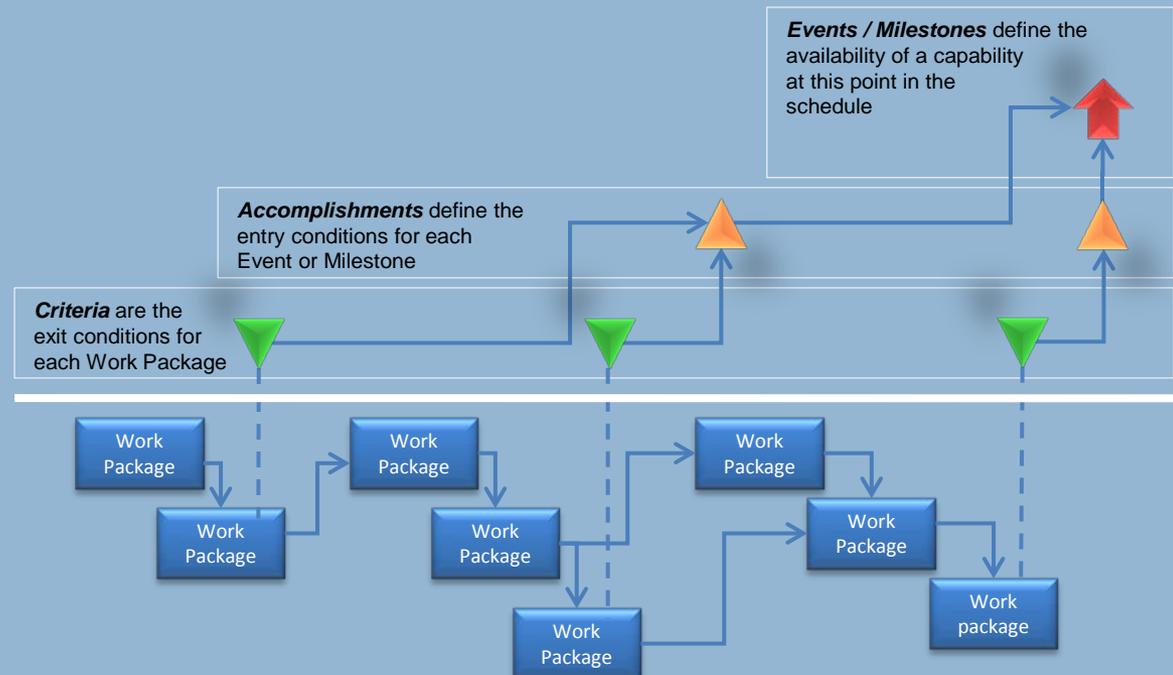
D

E

F

Minimal Marketable **Features** inside of **User Stories** inside of an **Epic**

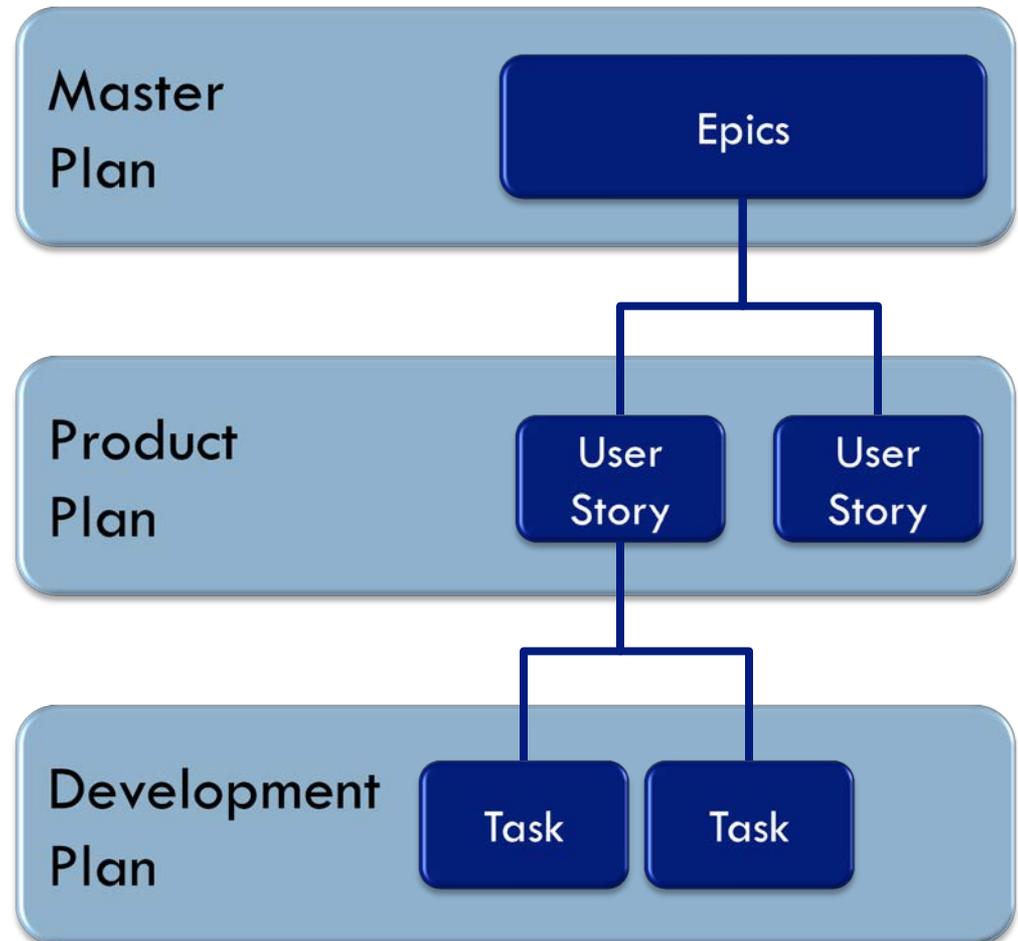
Define what deliverables are needed at the end of a phase, rolling wave, program event to fulfill the Technical Performance Measures, Performance Assessment Criteria, or assess the increasing maturity of the final deliverable, measured in units of *Physical Percent Complete - BCWP*.



# The WBS as an Agile Paradigm

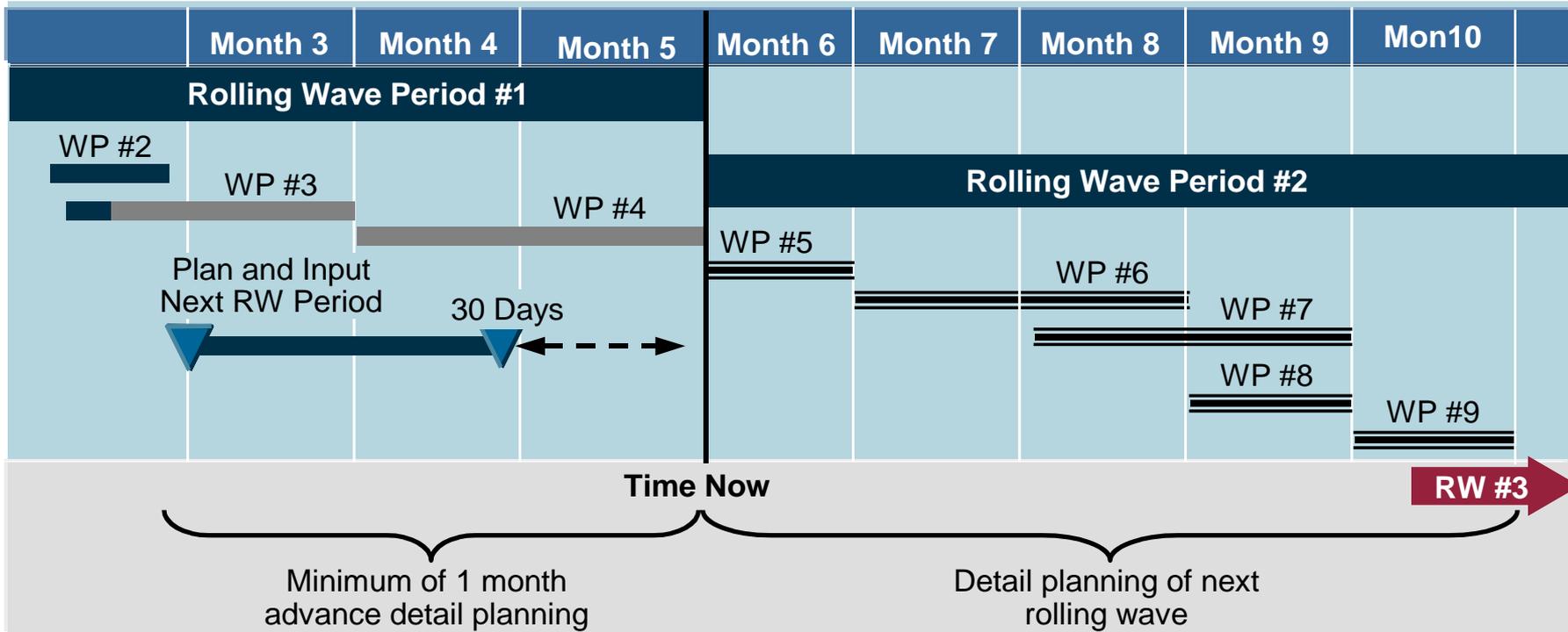
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- The top levels in the project plan are **Epics** and user stories.
- The project scope is described by **Epics**.
- The project budget starts on this **Epics** level.
- Further detailing on the **User Story** level and the sprint task levels.
- Full traceability top down and bottom up on cost and progress.



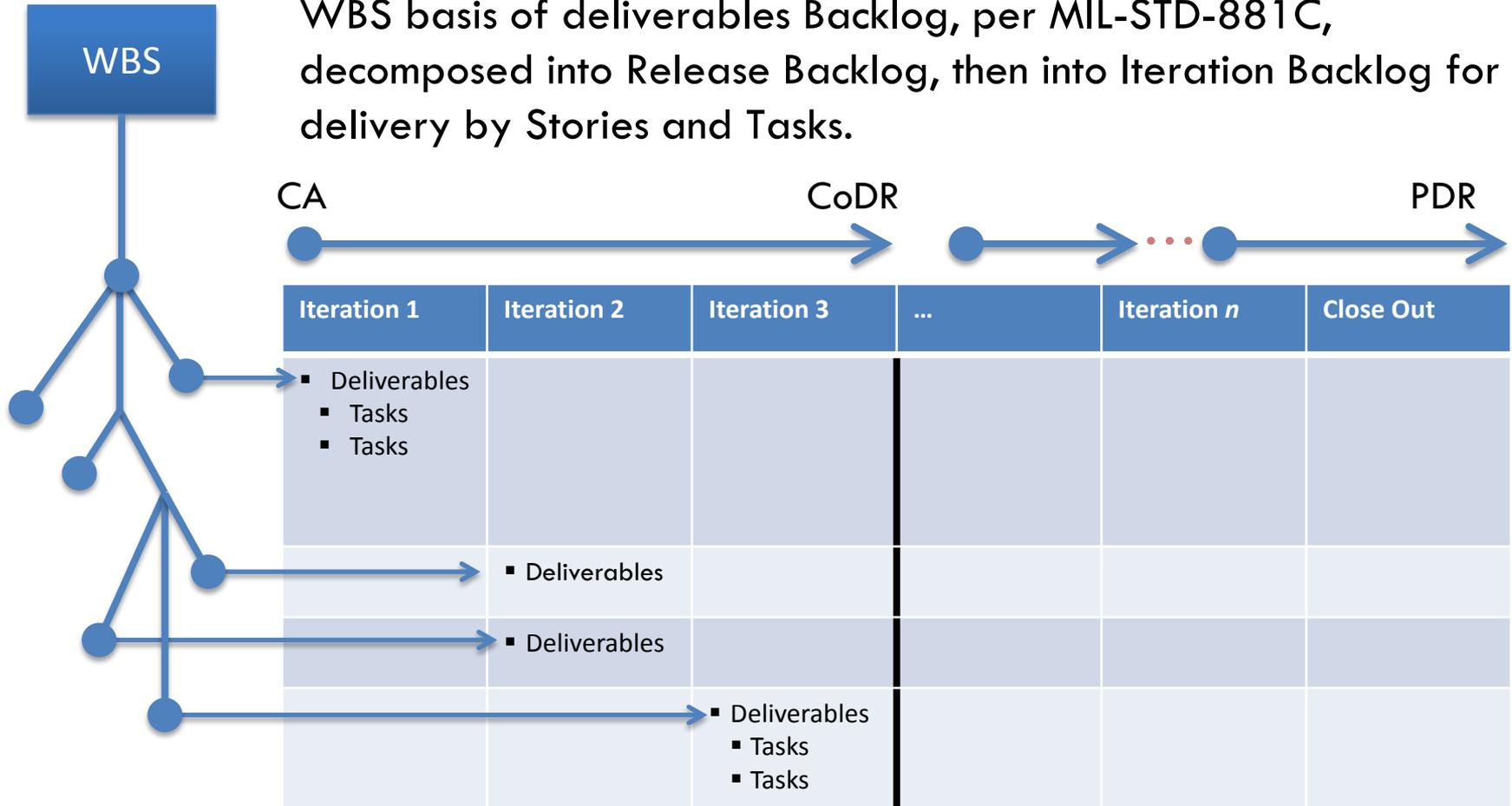
# The Starting Point for “Connecting the Dots” is the Rolling Wave

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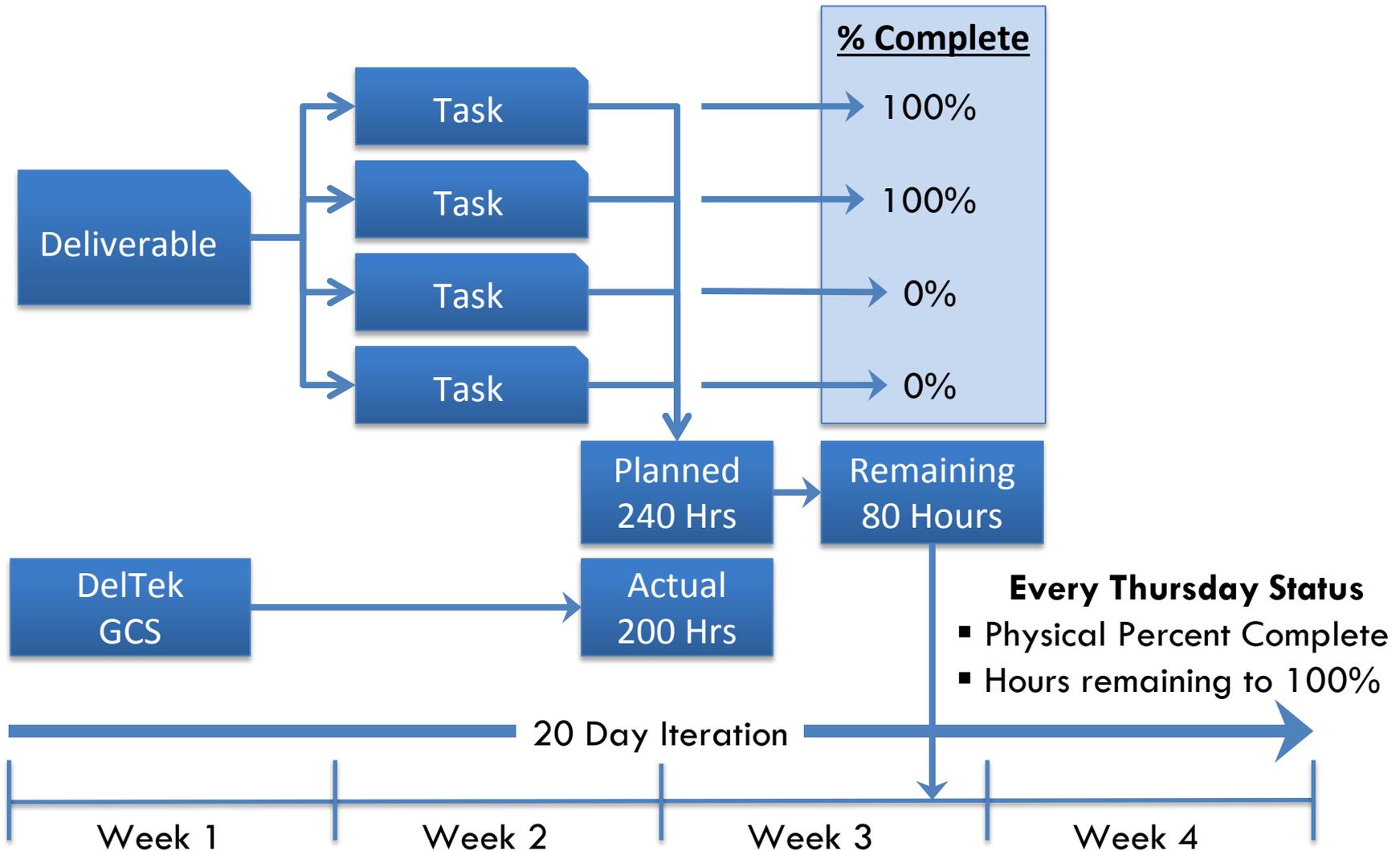
- Tune the Rolling Waves to the rhythm of the project.
- These cycles are below the NDAA Section 804 suggestions.
- EV allows adjustments to un-started work.

# Assigning Deliverables to Iterations from the WBS



# Performance Assessment On A Weekly Basis

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# 11 (EVM) Guidelines for the Success of any Project

21

- The 32 EVM Guidelines are all designed to deliver value.
- These 11 are the basis of all good program management.



# Here's Those Connections

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GL	EVM Criteria	Agile Approach
1	Define WBS	Features and Stories define tasks
2	Identify Organization	Self organizing teams
5	Integrate WBS and OBS	Self organized teams with a customer
6	Schedule Work	Iterations and Releases
7	Identify Products & Milestones	Working software at the end of iterations
8	Set time phased budget	Fixed length iterations and releases
16	Record direct costs	Fixed staff = Level of Effort
23	Determine variances	EV + Velocity measures missed features
25	Sum data and variance	Missed features moved to next iteration
26	Manage action plans	Replan missed features, adjust velocity
28	Incorporate changes	Replan missed features, adjust velocity

# But First, Let's Not Forget Business Management Practices ...



...That Must Be Recognized Before Connecting Agile and EVM

# Our First Conclusion

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- Epics, Stories, Tasks, and the Work Packages executing the Tasks are the same *Notion* in Agile and DoD Program Management.
- Earned Value *earns* the budget for the work that produces the *business value*.
- Both are needed to increase the Probability of Program Success (PoPS).
- Rolling Waves provide the mechanism to deal with emergence within the rules of the Performance Measurement Baseline (PMB).
- Agile focuses on code development.
- Earned Value focuses on the productivity of the resources developing that code – the *Efficacy of the Dollar*.

***Measures of Both are Needed to Increase PoPS***

# Some Killer Issues

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Big Question	A Possible Answer
How do we deal with emerging requirements	Baseline the needed capabilities, and let the technical and operational requirements <i>emerge</i> . This means agile software programs actually do need baselined capabilities. Then partition the requirements into rolling waves
What do we do with unfinished work at the end of an iteration.	Replanning is the first approach, into future planning packages.
The very basis of EVM is an <i>end-to-end</i> budget baseline	Rolling wave, planning packages, in smaller chunks is the start. But more thought is needed on how to stabilize the baseline.
What does DCMA think about all this fluidity?	Good question, but software development programs are poster child's for success now, we need something better



*He who rejects  
change is the  
architect of decay.*

*The only human  
institution which  
rejects progress is  
the cemetery.*

– Former Prime  
Minister of  
England,  
Harold Wilson



## Putting These Ideas To Work

Using the Earned Value Management Intent Guide (EVMIG), here's how to connect the dots at the next level down.

The 11 criteria of Earned Value connected with the 12 principles of Agile.

# GL 1: Define Authorized Work Elements

29

Define the authorized work elements for the program. A work breakdown structure (WBS), tailored for effective internal management control, is commonly used in this process.

## EVMIG Objective Evidence

- Work Breakdown Structure (WBS).
- WBS dictionary (may or may not be used, but a method to reconcile the statement of work to the WBS structure must be demonstrated).

## Agile Objective Evidence for EV

- Road Map & Release Plan consisting of Capabilities, Product Backlog & Iteration Backlog.
- WBS dictionary: agile user stories are deliverables that you can measure “done” for, therefore user stories satisfy wbs dictionary.

# GL 2: Identify Program Organizational Structure

30

Identify the program organizational structure, including the major subcontractors responsible for accomplishing the authorized work, and define the organizational elements in which work will be planned and controlled.

## EVMIG Objective Evidence

- Organization Breakdown Structure (OBS).
- OBS intersections with the WBS.

## Agile Objective Evidence for EV

- CAM just builds a team as usual, but the team needs to be persistent, and not interchangeable parts.
- Team hierarchy definition with resources associated with their sub-teams.
- Done at the level of granularity to support the basis of estimate (BOE).
- Persistent teams are needed to apply throughput benchmarks to product backlogs to validate plans.

# GL 3: Integrate WBS and OBS

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Provide for integration of the program work breakdown structure and the program organizational structure in a manner that permits cost and schedule performance measurement by elements of either or both structures as needed.

## EVMIG Objective Evidence

- Control accounts.
- Responsibility Assignment Matrix (RAM).
- Contract Performance Reports (CPRs), if applicable.

## Agile Objective Evidence for EV

- Evidence that the CA meets the 90% discrete work rule.
- Defend schedule & cost performance at the CA level?
- Agile CA = one release.
- Actuals captured at the story level.
- Done at too high a level for the SW development approach to make a difference.
- Given an objective of X stories in iteration Y, completed stories are earned; all unearned return to backlog and a new ETC is developed from the benchmarks & backlog.

# GL 6: Schedule the Work

32

Schedule the authorized work in a manner which describes the sequence of work and identifies significant task interdependencies required to meet the requirements of the program.

## EVMIG Objective Evidence

- Integrated network schedules including master, intermediate (if any), and detailed schedules.
- MRP or ERP schedules, or planned order reports.
- Control account plans (may be separate plans or detail schedules).
- Work authorization documents.

## Agile Objective Evidence for EV

- CAM's agile roadmap becomes the auditable intermediate schedule demonstrating significant accomplishments (SA).
- Each task in IMS has associated resources.
- CAM creates schedules compliant to DCMA 14 point assessment.
- Nothing different.

# GL 7: Identify Products and Milestones

33

Identify physical products, milestones, technical performance goals, or other indicators that will be used to measure progress.

## EVMIG Objective Evidence

## Agile Objective Evidence for EV

- | EVMIG Objective Evidence   | Agile Objective Evidence for EV   |
|--|---|
| <ul style="list-style-type: none"><li>▪ Integrated schedules including master, intermediate (if any), and detailed schedules that identify contract milestones and key events.</li></ul> | <ul style="list-style-type: none"><li>▪ Agile dev performance reporting follows the approved program system description</li><li>▪ Apportioned technical performance milestones to reduce risk &amp; roll up intermediate technical performance.</li></ul> |
| <ul style="list-style-type: none"><li>▪ MRP or ERP production planned order reports.</li></ul>   | <ul style="list-style-type: none"><li>▪ Not relevant to sw development.</li></ul>   |
| <ul style="list-style-type: none"><li>▪ Control account plans (may be separate plans or detail schedules)</li></ul>  | <ul style="list-style-type: none"><li>▪ Not relevant to sw development because we are reporting tasks as physical % complete, which will automatically roll up.</li></ul>   |

# GL 8: Set Time Phased Budget

34

Establish and maintain a time–phased budget baseline, at the control account level, against which program performance can be measured. Initial budgets established for performance measurement will be based on either internal management goals or the external customer negotiated target cost including estimates for authorized but undefinitized work.

## EVMIG Objective Evidence

## Agile Objective Evidence for EV

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>▪ Control account plans.</li></ul>                                   | <ul style="list-style-type: none"><li>▪ Time phased budget created for the current iteration(s) and future work.</li></ul>   |
| <ul style="list-style-type: none"><li>▪ Summary level planning packages.</li></ul>                         | <ul style="list-style-type: none"><li>▪ Agile summary level planning documented in road map. Comprises capabilities, features and stories</li><li>▪ Agile planning packages driven by persistent teams with proven benchmarks.</li></ul> |
| <ul style="list-style-type: none"><li>▪ Performance Measurement baseline.</li></ul>                        | <ul style="list-style-type: none"><li>▪ Is there a target threshold for future work as described in a PMB? Within 10% OTB?</li></ul>   |
| <ul style="list-style-type: none"><li>▪ Undistributed budget logs.</li></ul>                               | <ul style="list-style-type: none"><li>▪ Does this have anything to do with SW dev approach?</li></ul>  |
| <ul style="list-style-type: none"><li>▪ Notification to the customer of an over–target baseline.</li></ul> | <ul style="list-style-type: none"><li>▪ Does this have anything to do with SW dev approach?</li></ul>  |
| <ul style="list-style-type: none"><li>▪ Work authorization document.</li></ul>                             | <ul style="list-style-type: none"><li>▪ Does this have anything to do with sw dev approach?</li></ul>  |

# GL 16: Record Direct Costs

35

Record direct costs in a manner consistent with the budgets in a formal system controlled by the general books of account.

## EVMIG Objective Evidence

- Reconciliation of project costs with the accounting system.
- Actual costs are reported at the control account level at a minimum.
- Reconciliation of subcontract reported actual costs to subcontract payments.
- Internal and external performance reports for subcontractors.
- Subcontractor control account plans, when utilized.

## Agile Objective Evidence for EV

- CAM would follow program direction on these.
- These are not impacted by sw dev approach
- Not impacted by SW development approach.

# GL 23: Determine Variances

36

Identify, at least monthly, the significant differences between both planned and actual schedule performance and planned and actual cost performance, and provide the reasons for the variances in the detail needed by program management.

## EVMIG Objective Evidence

- Variance analyses (budget based schedule variances and cost variances).
- Management action plans.
- Updated schedule task completion and cost-at-completion forecasts.
- Project schedules and schedule analysis outputs.

## Agile Objective Evidence for EV

- Can track & report variances per the approved program system description
- Actionable recovery plans per issue.
- Scrum Agile has a POD and Plan for Iteration.
- CAM's monthly EAC reporting follows the approved program system description
- PM tracks the dynamic backlog, which will go up and down based on sponsor feedback

# GL 25: Summarize Variances

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Summarize the data elements and associated variances through the program organization and/or work breakdown structure to support management needs and any customer reporting specified in the project.

## EVMIG Objective Evidence

## Agile Objective Evidence for EV

<ul style="list-style-type: none"><li>▪ Variance analyses.</li></ul>	<ul style="list-style-type: none"><li>▪ There is nothing in Agile's approach to SW development that precludes reporting variances at the WP level.</li><li>▪ Agile is more dynamic than EVM so variances are less the issue than the evolving baseline, as approved in governance. The sponsor will want to track accumulating business value and variances to total product needs.</li></ul>
<ul style="list-style-type: none"><li>▪ Schedule and cost performance reports.</li></ul>	<ul style="list-style-type: none"><li>▪ Similar – but measures of performance not usually in dollars</li></ul>
<ul style="list-style-type: none"><li>▪ Management action plans.</li></ul>	<ul style="list-style-type: none"><li>▪ Similar – but less formal. Collaborative discussion of what actions to take include the customer.</li></ul>
<ul style="list-style-type: none"><li>▪ Updated schedule and cost forecasts.</li></ul>	<ul style="list-style-type: none"><li>▪ Similar – but less formal. Planning processes include the customer.</li></ul>

# GL 26: Implement Management Plan

38

Implement managerial action taken as the result of earned value information.

EVMIG Objective Evidence	Agile Objective Evidence for EV
<ul style="list-style-type: none"> <li>▪ To-Complete Performance Index (TCPI).</li> </ul>	<ul style="list-style-type: none"> <li>▪ <math>TCPI = \text{Work Remaining} / \text{Cost Remaining} ((BAC - BCWP_{cum}) / (EAC - ACWP_{cum}))</math>. In Agile, work remaining is the product backlog. Backlog is <math>BAC - BCWP</math>.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Independent completion estimates.</li> </ul>	<ul style="list-style-type: none"> <li>▪ No longer used in 2010</li> </ul>
<ul style="list-style-type: none"> <li>▪ Risk management data and similar metrics.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Qualitative Risk Burn-down Chart (risk rating)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Management action plans and review briefings.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Agile approach called Commitment Based Planning – where the SCRUM team makes and meets its time phase BCWS commitments.</li> <li>▪ Any team, when behind, gives voice to the customer when evaluating/reweighting the triple constraint.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Variance analyses.</li> </ul>	<ul style="list-style-type: none"> <li>▪ This is an issue of cost mgmt and system description would define when and where team members would bill</li> </ul>

# GL 28: Incorporate Changes (1)

39

Incorporate authorized changes in a timely manner, recording the effects of such changes in the budgets and schedules.

## EVMIG Objective Evidence

## Agile Objective Evidence for EV

- | EVMIG Objective Evidence  | Agile Objective Evidence for EV   |
|---|---|
| ▪ Contractual change documents.   | ▪ Bug reports, new user stories, but not necessarily cost sized.  |
| ▪ Change control logs (management reserve, undistributed budget, performance measurement baseline, and contract budget base). | ▪ User stories above baseline are tracked as new scope (with a valid BOE) and require BCWS  |
| ▪ Control account/work package/planning package plans.  | ▪ New or materially altered features or stories are changes.<br><br>▪ Product and iteration backlogs are frozen during the development period |

# GL 28: Incorporate Changes (2)

40

Incorporate authorized changes in a timely manner, recording the effects of such changes in the budgets and schedules.

## EVMIG Objective Evidence

- Master schedules, intermediate schedules (if any), and detailed schedules.
- Statement of work, WBS, and WBS dictionary.
- Work authorization documents.
- Management reports (contract performance reports or other applicable management reports).

## Agile Objective Evidence for EV

- Iterations and evolutionary planning at the detailed levels merges with the end to end planning for agile.
- Customer owner and Planning processes identify requires work and its description.
- Planning sessions, authorize a set of Stories to be developed during the iteration.
- Big Visible Charts, “sticky notes” display progress to plan for the agile team.

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## Performance-Based Project Management<sup>®</sup>

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