

An Industry Practice Guide for Agile on Earned Value Management Programs

March 26, 2018

Version 1.2

Course Content & Learning Objective



Chapters 1 thru 6 of the guide present the recommended approach for:

1. Establishing a product planning cycle that is driven by prioritization of the business cycle defined by the customer
2. Developing of the program WBS, IMP and IMS on an Agile development program
3. Planning program scope and assess progress within an Agile development framework
4. Analyzing program performance using Agile and EVM metrics
5. Implementing changes in a controlled manner
6. Contracting / Acquisition Considerations for Agile and EVM

Appendix A thru E provide:

- A. Agile/EVM Data Dictionary
- B. Examples of EVM Agile progress report charts
- C. List of Agile and EVM reference materials
- D. Details on the Product Roadmap, Release Planning, and Rolling Wave Planning
- E. IBR Considerations

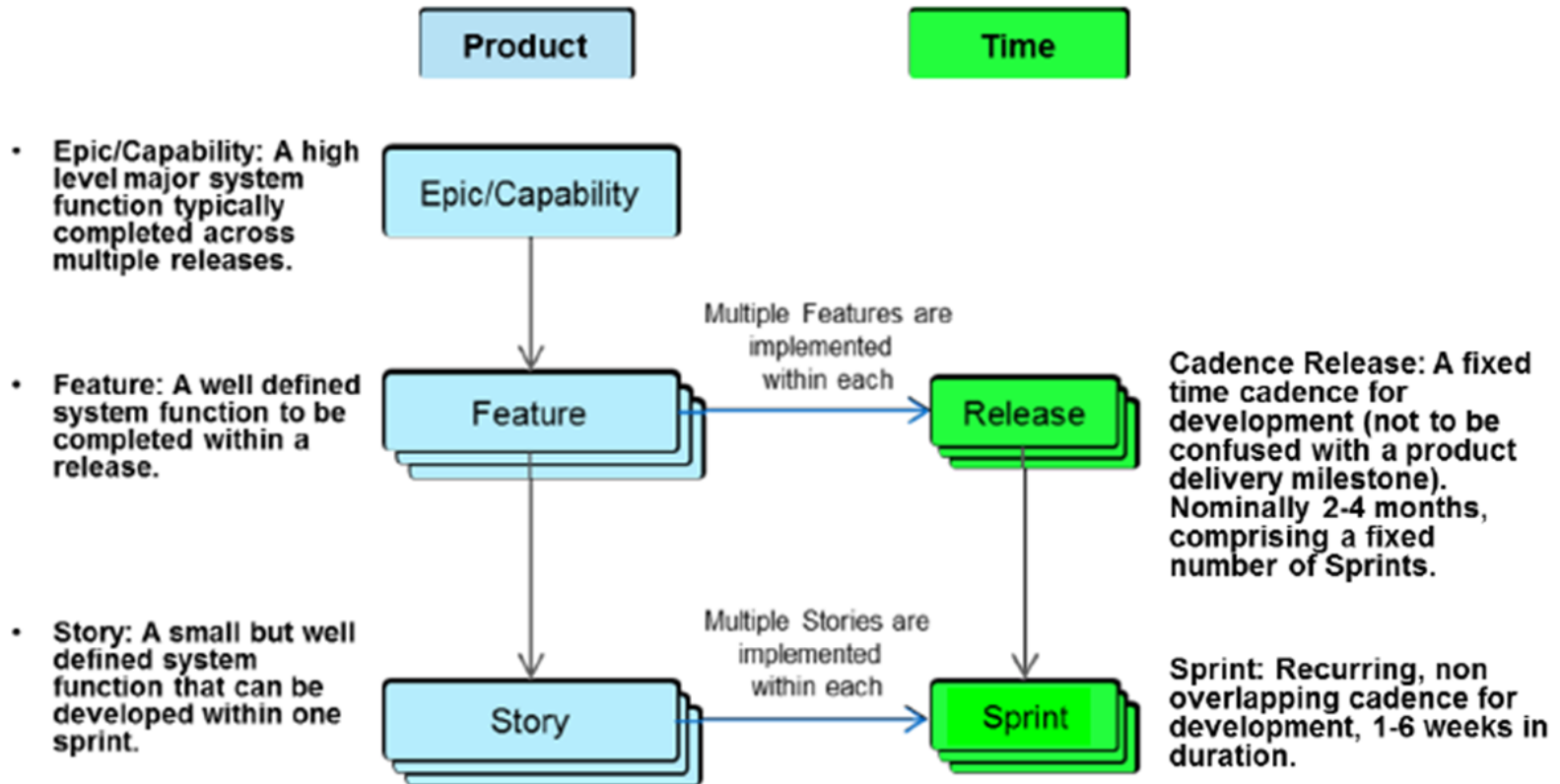
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AGILE PROGRAM PLANNING

Agile Planning Levels Related to EVM Processes

Planning Level	Planning Frequency	Planning Horizon	Planning Precision	Planning Artifact	EVM Processes
Product Planning	Project startup; updates throughout the project	Project Duration	Capabilities Releases	Product Backlog; Prod Roadmap, Minimal Viable Product (MVP)	IMP planning of Epics/ Capabilities to Releases (Cadency and Capability).
Release Planning	Each Cadence Release	Cadence Release	Feature /Stories	Product Backlog Updates Release Plan	IMS planning of Features to Work & Planning Packages. Networking them to Capabilities and Releases.
Sprint Planning	Each sprint	Weeks	Stories/Tasks	Sprint Backlog	Defining measure of effort and duration for Work and Planning Packages based on Release Sprint Story alignment to Features.
Daily Planning	Daily	Day	Tasks	Updated Sprint Backlog	Update story status in order to determine EV for each Work Package

Agile EVM Terminology



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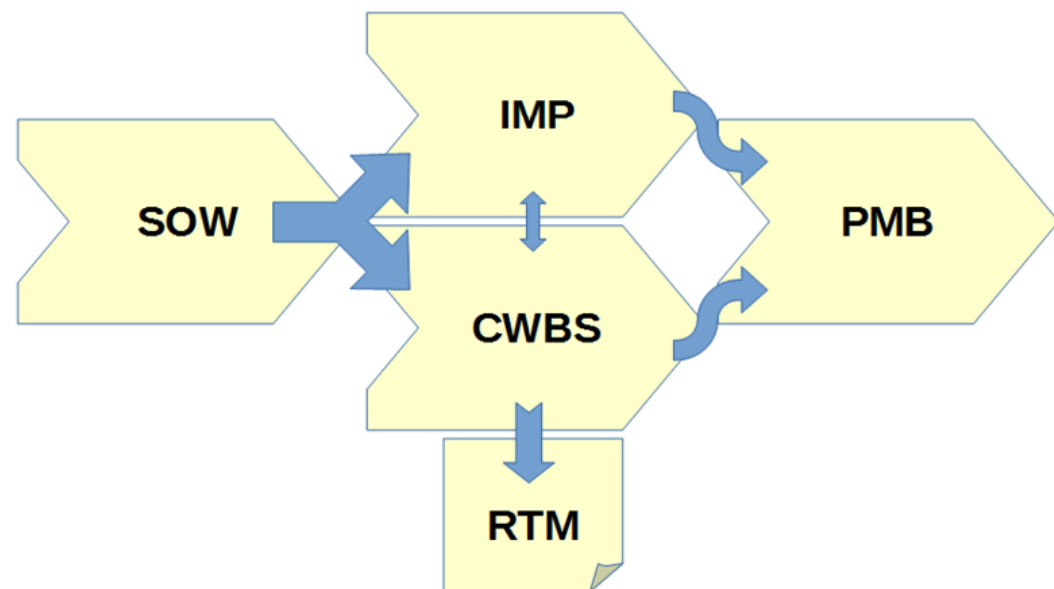
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AGILE EVM PERFORMANCE MEASUREMENT BASELINE

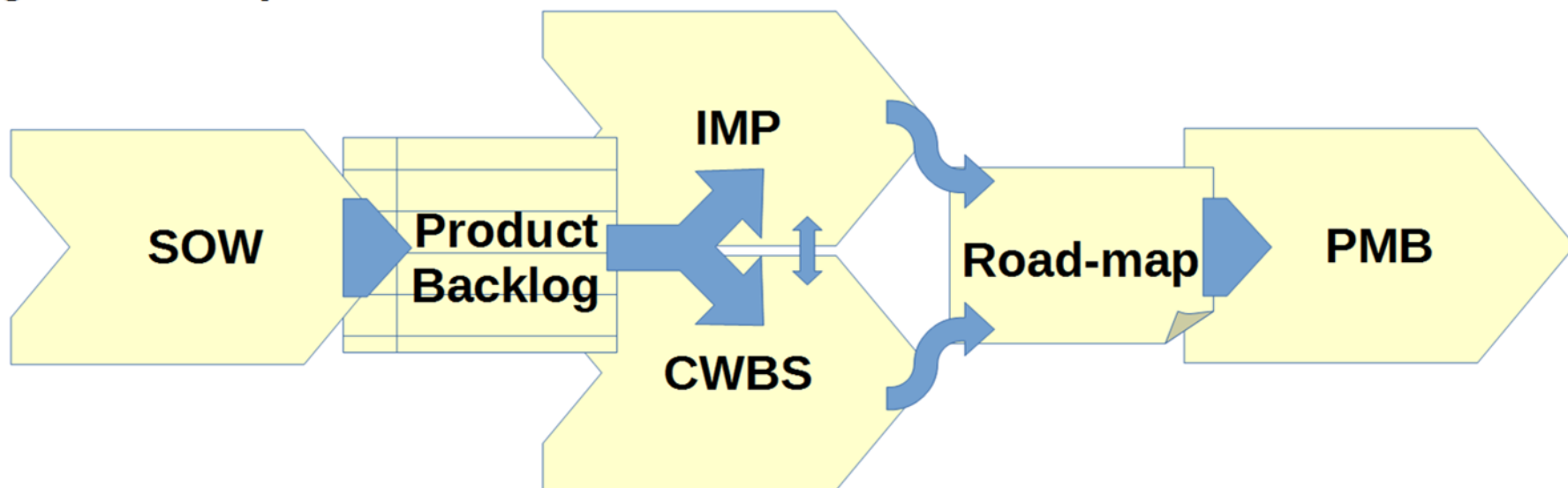
Traditional EVM Decomposition

- Traditionally, a statement of work (SOW) is broken down by a team into manageable chunks through WBS and OBS decomposition into a product-oriented view of a program.
- Engineering manages the requirements traceability matrix (RTM) and works to ensure traceability is maintained to the original SOW as the solution matures.

Traditional EVM Decomposition



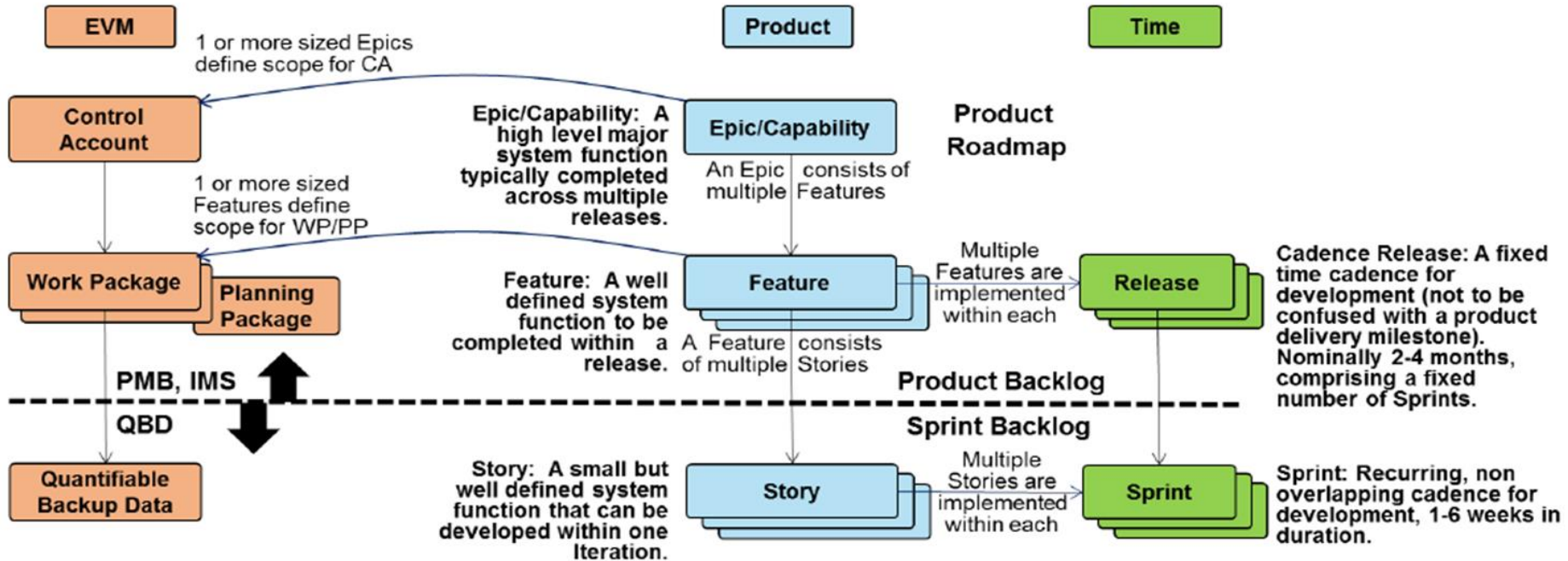
Agile Decomposition



Agile EVM Decomposition

- Agile software and management methods do not introduce significant changes to the typical approach. Instead, it provides the same type of trace to the original SOW by emphasizing the product backlog development.
- Product backlog prioritization determines the overall vision for the program from a business and project standpoint which helps to establish the IMP, CWBS and road-map used for execution.
- The Roadmap then helps with establishing the IMS and PMB.

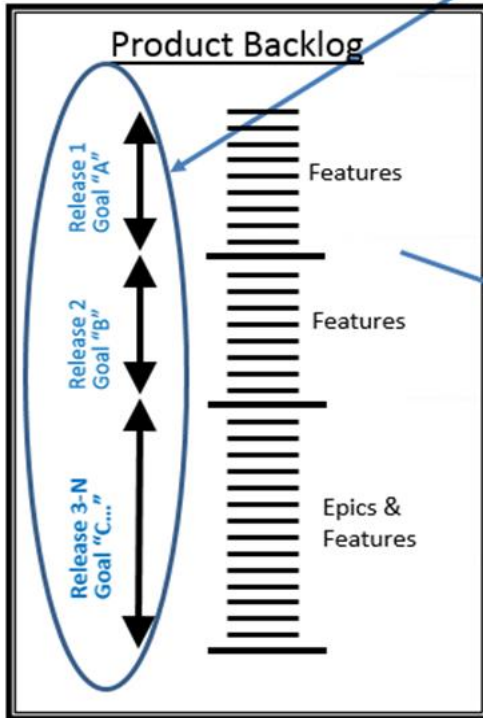
Alignment of EVMS to Agile Hierarchy



Product Backlog and the IMS

DEFINE THE WORK

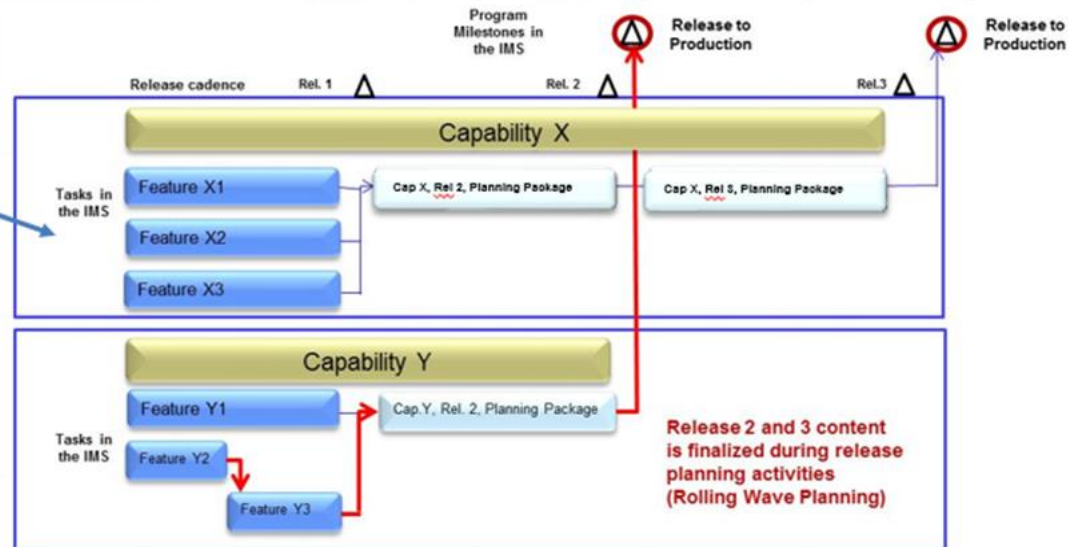
SOW Requirements are mapped to Epics and Features in the **Product Backlog**



PLAN THE WORK

The Program Plan is reflected in the **Product Roadmap**, which is an initial allocation of Features and Epics from the Product Backlog to releases based on the objectives and goals of each release.

SCHEDULE THE WORK

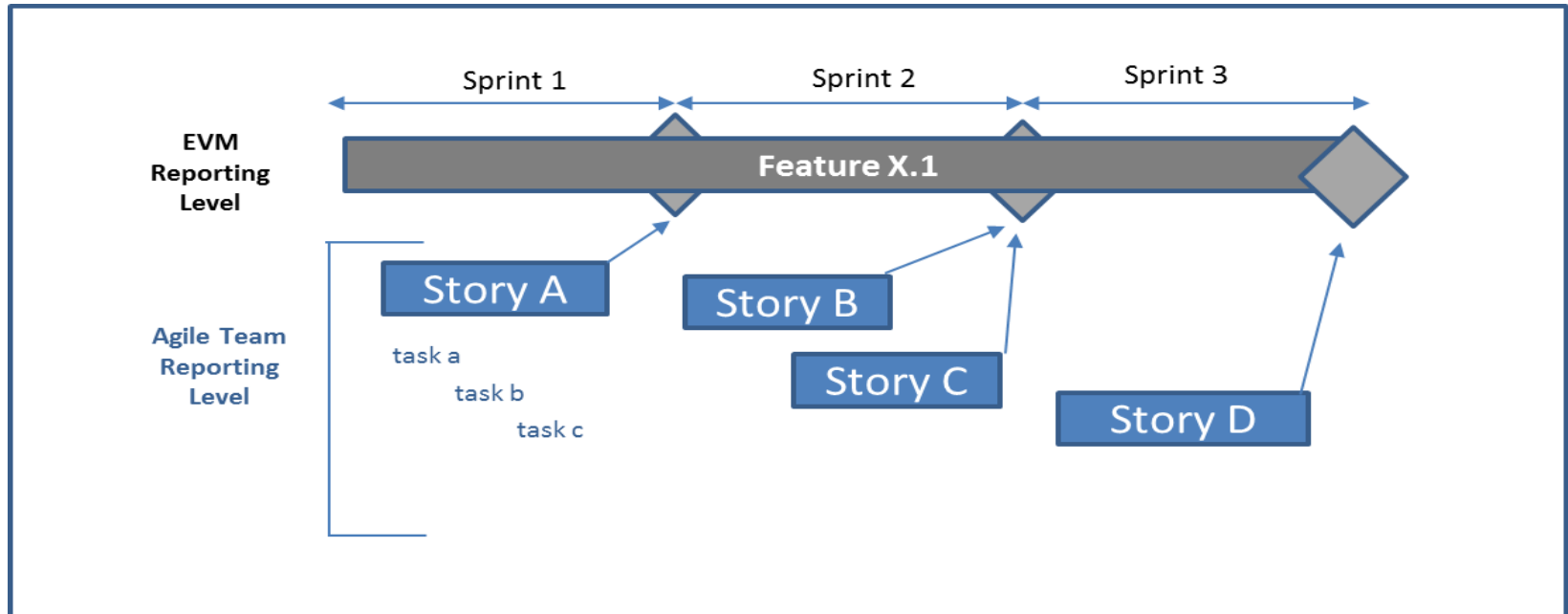


Features are prioritized using the Product Roadmap and planned in the **IMS**.

4

STRUCTURES FOR PERFORMANCE METRICS

Measuring Earned Value in Agile



- Agile Teams monitor status of Tasks and Stories within a Sprint
- Earned Value is measured at the Feature Level based on completed Stories
- Feature % Complete is calculated as completed Story Points divided by total Story Points

Computing Percent Complete & BCWP

Agile Tool ID	Task Description	Story Points	Story Weighting	Story Complete %	NWA %Claim
PMG-245	Story #1 Title	2	8.7%	100%	8.7%
PMG-246	Story #2 Title	5	21.7%	0%	0%
PGM-247	Story #3 Title	8	34.8%	100%	34.8%
PGM-248	Story #4 Title	5	21.7%	0%	0%
PGM-249	Story #5 Title	3	13.0%	0%	0%
	Total Story Points	23	100%		43.5%

Figure 8: Another example of how planned Story Points, or weighted Story Values, may be applied to create QBD to calculate earned value as a PC.

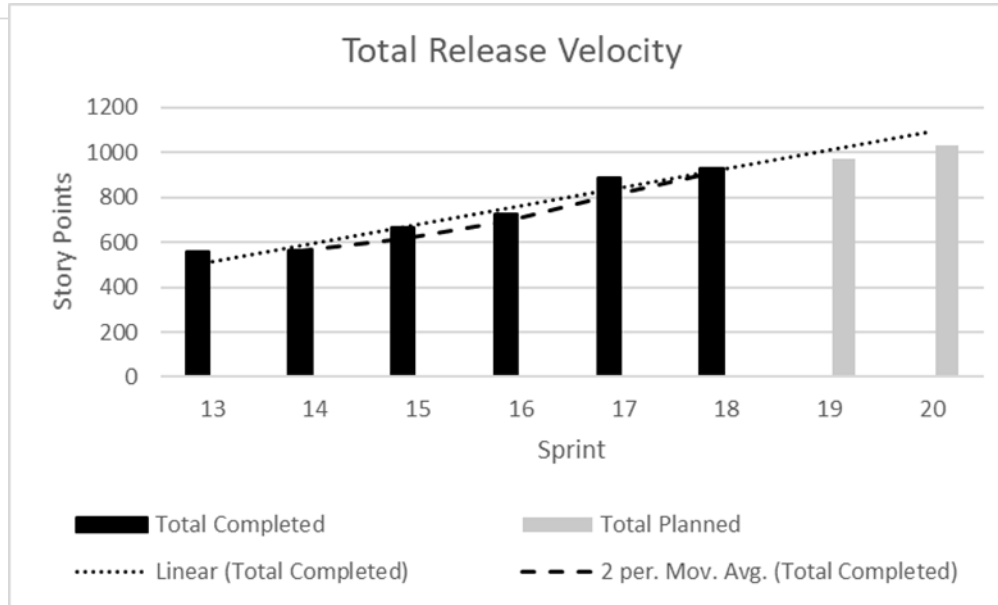
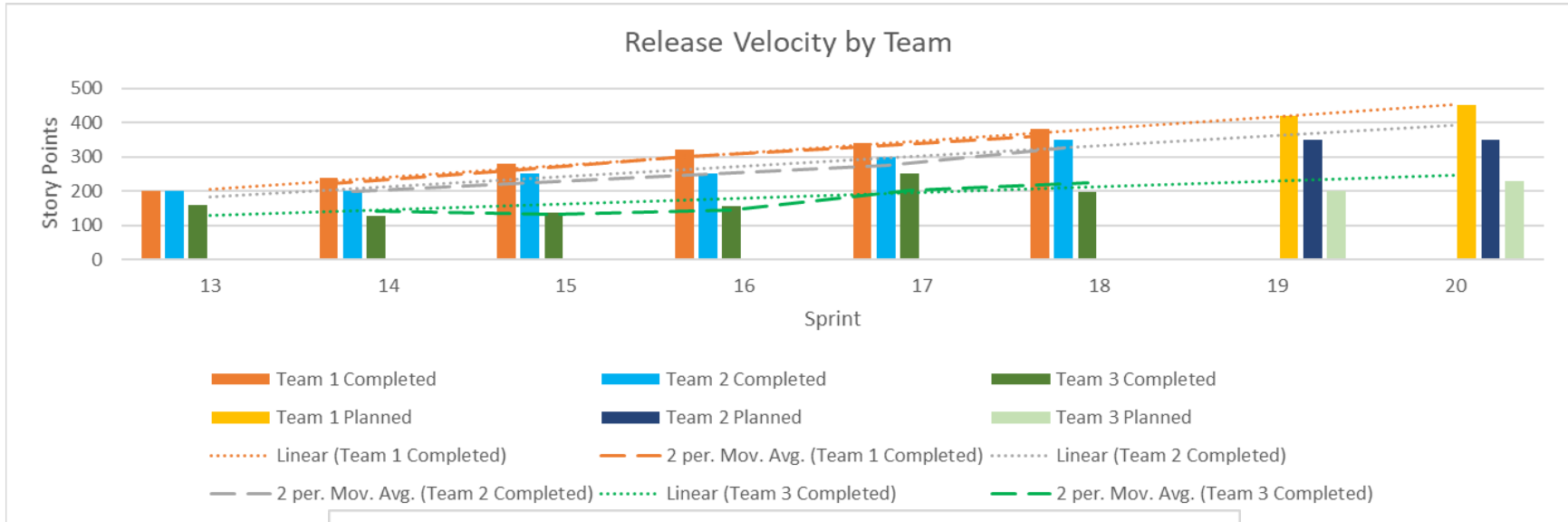
Example Forecast Formulas

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v1.1 March 31, 2017

$$\text{Feature Percent Complete} = \frac{\text{Total Completed Weighted Stories (in SP)}}{\text{Total Planned Weighted Stories (in SP)}}$$

$$\begin{aligned} \text{Feature Remaining Effort Hours} \\ = (\text{Total Planned SP} - \text{Total Completed SP}) \times \frac{\text{Total Hours for Sprints to Date}}{\text{Total Completed SP}} \end{aligned}$$

Example Velocity Chart



Example Release Burn-Down Chart

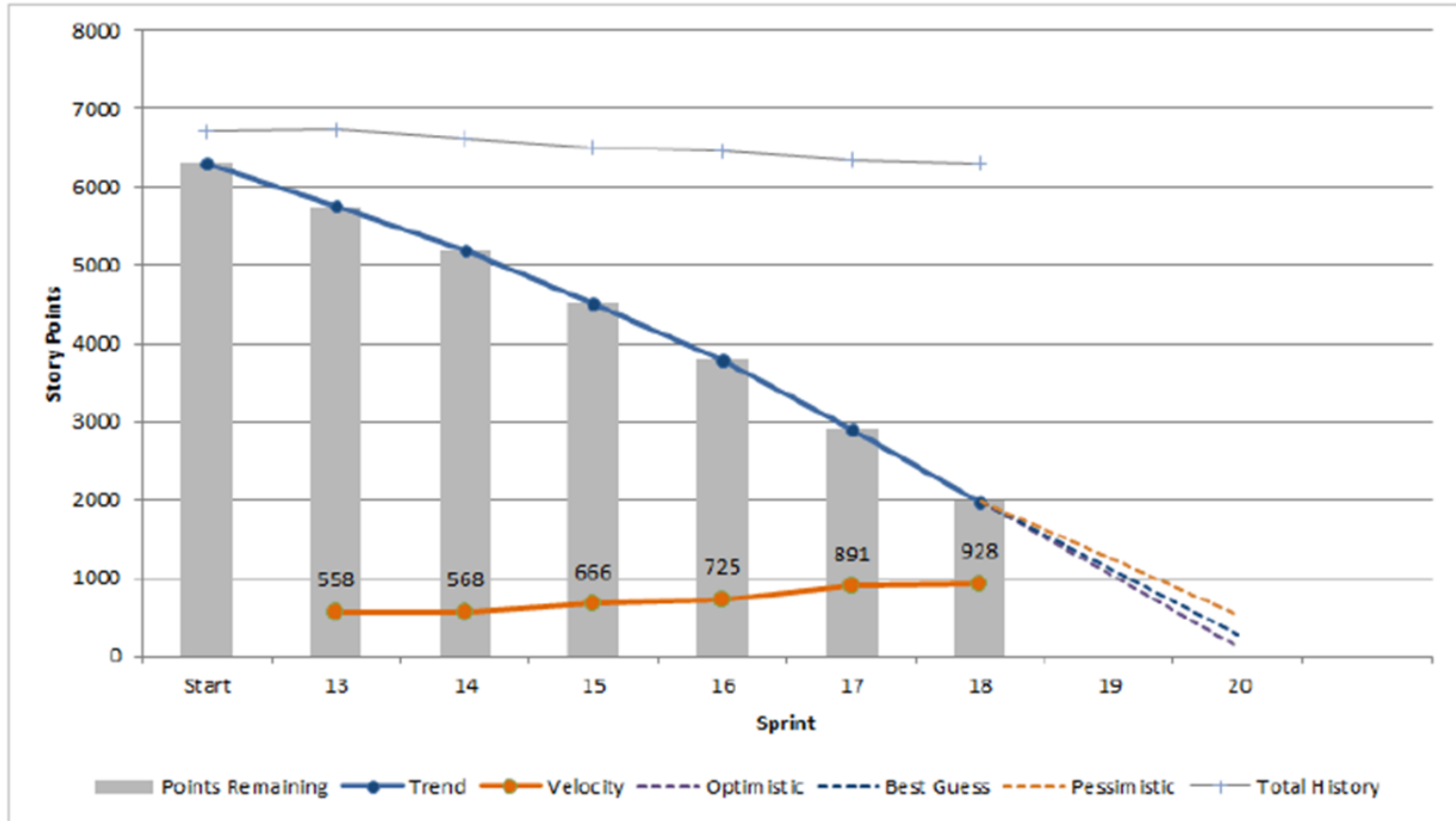


Figure 12: Example of a program level burndown chart across multiple teams, indicating overall status and predicted completion Sprint.

5

MANAGING BASELINE CHANGE ON AGILE PROGRAMS

Controlling Baseline Changes

- Baseline change rules apply as prescribed by your company's EVM System Description
- May not revise the scope, schedule or budget of a Epic/Capability or a Feature without following your company's documented change control procedures.
- May add, modify or remove Stories during Backlog refinement as needed to implement the feature scope.
 - User stories describe the team's intent of how the exit criteria of the Feature Work Package will be satisfied and are developed and maintained below the level of the EVMS PMB.
 - Configuration control of the stories is maintained within your Agile tool so all changes to a Story will be documented.
- The program does Rolling Wave planning at Cadence Release points to allow for flexibility and discovery. Rolling wave planning occurs after the Release Planning Event.
- The Contractor should establish a Freeze Period that supports the flexible nature of Agile development.

Cadence Release Planning/EVM Rolling Wave Planning



- **The Cadence Release Plan defines the set of Features that have been refined from Epics/Capabilities on the Product Roadmap that will be implemented within the Agile Cadence Release/EVM Rolling Wave period.**
 - The CAM uses the output of release planning to implement the EVM Rolling Wave Plan
 - PPs are converted to WPs (Features), Features are decomposed into Stories which are sized to facilitate the measurement of progress
 - The feature(s) are input into the IMS along with predecessor/successor task relationships, and then fed into the EV engine. The CAM validates the Product Backlog and Product Roadmap are consistent and traceable to the EVM data prior to approval
- **Work cannot start on the scope planned at the Release Planning event until it is incorporated and approved in the EVM PMB.**

Agile Freeze Period Considerations

- To avoid any misinterpretation of the DoD EVMSIG with respect to the freeze period, the freeze period should be adjusted, through formal changes to a company's System Description or other supplementary guidance, to be short enough that it accommodates the Agile planning cycle.
- A key point is that planning, including detail planning of planning packages, completes prior to the start of work for any of the products in the upcoming Cadence Release.
- It is acceptable to decompose planning packages and create work packages inside the current period for work that has not yet started. The detail plan must be approved prior to the start of the work, and such an approach must be compatible with the contractor EVM System Description.

Traceability of Baseline Changes across Agile and EVM artifacts

- A Release Roadmap is maintained that documents the prioritized product Backlog. Epics and Features on the Product Backlog are mapped to specific releases as part of the Product planning process.
- The Product Backlog documents the technical scope of each CA. Each CA maps to a subset of backlog items.
- All Items listed on the Product Backlog and Product Roadmap are consistent and traceable to a Work Package or Planning Package in the PMB
- If a baseline change has been made to a WP, the change must be traceable thru the Agile artifacts

- ▶ The backlog includes a coding structure that traces to the CAP. (WP's and PP's)
- ▶ Budgets for Features are allocated based on complexity of the effort
- ▶ The Control Account BAC represents the planned cost for completing the product (EPIC)



The Product Backlog traces to the Control Account Plan

Baseline Change Scenarios

	Scenario	PMB	Backlog
1	The Work Package/Feature is 30% complete, but did not complete by the formal delivery date. The delivery date is held as planned and the customer accepts the delivery without the Feature functionality.	Although the customer accepted the delivery without the functionality of this Work Package's Feature, the scope will continue on, showing a schedule variance (SV) until the work is complete.	The unfinished Feature's stories are moved to the next release and planned in a Sprint.
2	The Contracting Officer (CO) issues a contract letter which removes the scope of an Epic/Capability (requirement). The change affects a Feature which is currently baselined in an open Work Package.	Baseline Change: The in-progress WP is closed by setting BCWS equal to BCWP. The entire unclaimed budget associated with the Epic/Capability is returned to Undistributed Budget (UB) until dispositioned by contract mod (de-scope).	The unfinished Stories, Features, and Epic/Capabilities are removed from the Product Backlog.
3	The exit criteria for Feature 1 Work Package is updated to add additional functionality (requirements) to that Feature. Stories are created to satisfy the additional requirements. The important consideration here is that the exit criteria of the Feature Work Package has changed.	Baseline Change: The scope of Feature 1 has increased. Budget must be added for that new scope. If this is the result of a customer desired enhancement (new scope to the contract) the budget will come from UB. If this is an unplanned in-scope increase the budget will come from Management Reserve (MR).	The exit criteria for Feature 1 is updated. Stories are created and added to the Product Backlog and mapped to Feature 1.

Forecast Change Scenarios

	Scenario	PMB	Backlog
1	A Feature work package that spans 3 sprints has started. The team determines that some of the Stories mapped to the Feature planned in the first Sprint will not be completed and move those Stories to Sprint 4, which is beyond the baseline finish date of the Feature.	No change to the Feature Work Package baseline budget or baseline schedule. The in-progress Feature IMS task shows a slip to the baseline finish date. BCWP is only claimed for the Stories actually completed. BCWP compared to BCWS identifies a schedule variance. Reflect changes in IMS Forecast and EAC.	The Product Backlog is updated to move the Stories not completed in the first Sprint into the fourth Sprint.
2	The PO and team determine a Story is deemed unnecessary for the accomplishment of the Feature due to an increased understanding of Feature exit criteria (requirements). <i>The Exit Criteria for the Feature has not changed.</i> The Feature WP is in progress and the subject Story is a QBD.	No change to Feature Work Package baseline budget or baseline schedule. Feature QBD is updated to remove the Story. Removal of the Story from QBD may result in an increase in Feature WP percent complete since the percentage of unfinished effort has decreased. Reflect changes in IMS Forecast and EAC.	The Story is removed from the Product Backlog.
3	Features mapped to future releases are reprioritized based on discovery/user feedback and mapped to other future releases in a Planning Package.	No change to budget or baseline schedule. This is not a baseline change because this work has not been detail planned. This kind of re-prioritization is expected, however, the roadmap should be analyzed for potential bow-wave and critical path impacts. If a bow-wave is apparent, a baseline change may be required to adjust the PP monthly budget spread. Reflect changes in the IMS forecast and EAC.	The product Backlog is updated and the Features are mapped to the resulting releases on the release roadmap.

6

CONTRACTING FOR AGILE AND EVM

- This section provides contracting considerations and guidance specifically for programs using Agile development methods with and EVM requirement.
- See section 6 of the guide for more details.

Appendix A

EVM/AGILE DATA DICTIONARY

Appendix A - EVM/Agile Data Dictionary

This appendix is organized into three sections.

1. **EVM Agile Data Dictionary.** This section provides an EVM Agile Data Dictionary and thesaurus of Agile terms and rationale. The intent is to create a common vernacular and a method to harmoniously blend EVM and Agile program management practices.
2. **Agile Data Dictionary.** The section is a combination of Agile terms from Scrum Alliance and Agile Alliance.
3. **EVM Data Dictionary.** This section includes common EV Systems Management (EVMS) terminology consistent with the EIA-748 Standard for EV Systems.

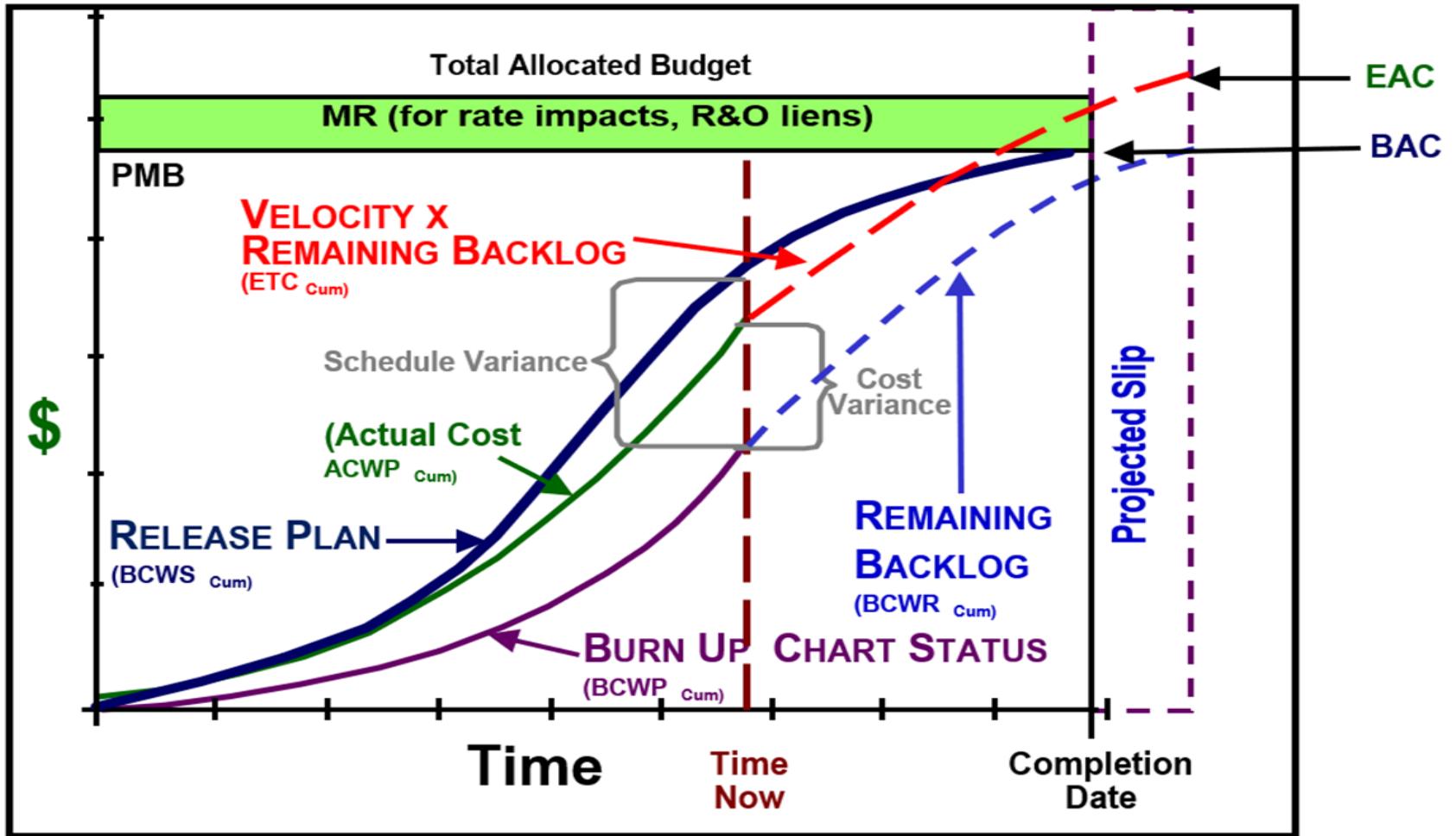
Principles mapped to Agile Concepts

EVM Principle	SW Development Programs (Agile)
Decomposition of work into manageable pieces.	EPIC and Feature Based WBS for SW (Product Backlog)
Assignment of resources against that work.	SW Development Teams (Sprint Teams)
Assigning value to work to be accomplished.	Business Value assigned at Feature level and above; story point values used to plan and execute the detailed work
Time phasing of the work	Roadmap->Release Planning->Sprint Planning. Priority based execution to deliver incremental capability.
Tracking performance against technical objective criteria to claim value.	Agile metrics: Velocity, burndown and burn up charts, etc. EVM Metrics: CPI, SPI, TCPI, Variance Analysis, done at feature level of above.
Compare claimed value, actual costs, and planned value to support daily decision making.	Sprint Retrospective, Story point claims, EVM % complete taken at feature level of above.
Updating forecasts and technical plan as the team learns from history.	Agile is in a constant state of planning and executing, allows for creating a forecast as often as daily.

Appendix B

**EXAMPLES OF AGILE EVM
PROGRESS TRACKING CHARTS**

Platinum Card EVM for Agile Development



Platinum Card Formulas

Variations Positive is Favorable, Negative is Unfavorable

Cost Variance	CV	= Burn Up Status – Actual Cost (BCWP – ACWP)
	CV %	= (CV / BCWP) * 100
Schedule Variance	SV	= Burn Up Status – Release Plan (BCWP – BCWS)
	SV %	= (SV / BCWS) * 100
Variance at Completion	VAC	= BAC – EAC
	VAC %	= (VAC / BAC) * 100

DoD Metrics

Favorable is > 1.0, Unfavorable is < 1.0

Cost Efficiency	CPI	= Burn Up Status / Actual Cost (BCWP / ACWP)
Schedule Efficiency	SPI	= Burn Up Status / Release Plan (BCWP / BCWS)

Program Agile Team Estimate @ Completion

ETC	= Velocity x Remaining Backlog
EAC	= Actual Cost + (Velocity x Remaining Backlog)

Independent Estimate @ Completion

= ACTUALS TO DATE + [(REMAINING WORK) / (PERFORMANCE FACTOR)]

$$EAC_{CPI} = ACWP_{CUM} + [Remaining\ Backlog / CPI_{CUM}]$$
$$= ACWP_{CUM} + [(BAC - BCWP_{CUM}) / CPI_{CUM}]$$

$$EAC_{Composite} = ACWP_{CUM} + [Remaining\ Backlog / (CPI_{CUM} * SPI_{CUM})]$$
$$= ACWP_{CUM} + [(BAC - BCWP_{CUM}) / (CPI_{CUM} * SPI_{CUM})]$$

To Complete Performance Index (TCPI) = Work Remaining / Cost Remaining

$$TCPI_{EAC} = Remaining\ Backlog / (Velocity * Remaining\ Backlog)$$
$$= (BAC - BCWP_{CUM}) / (EAC - ACWP_{CUM})$$

Example: Progress Tracking Report

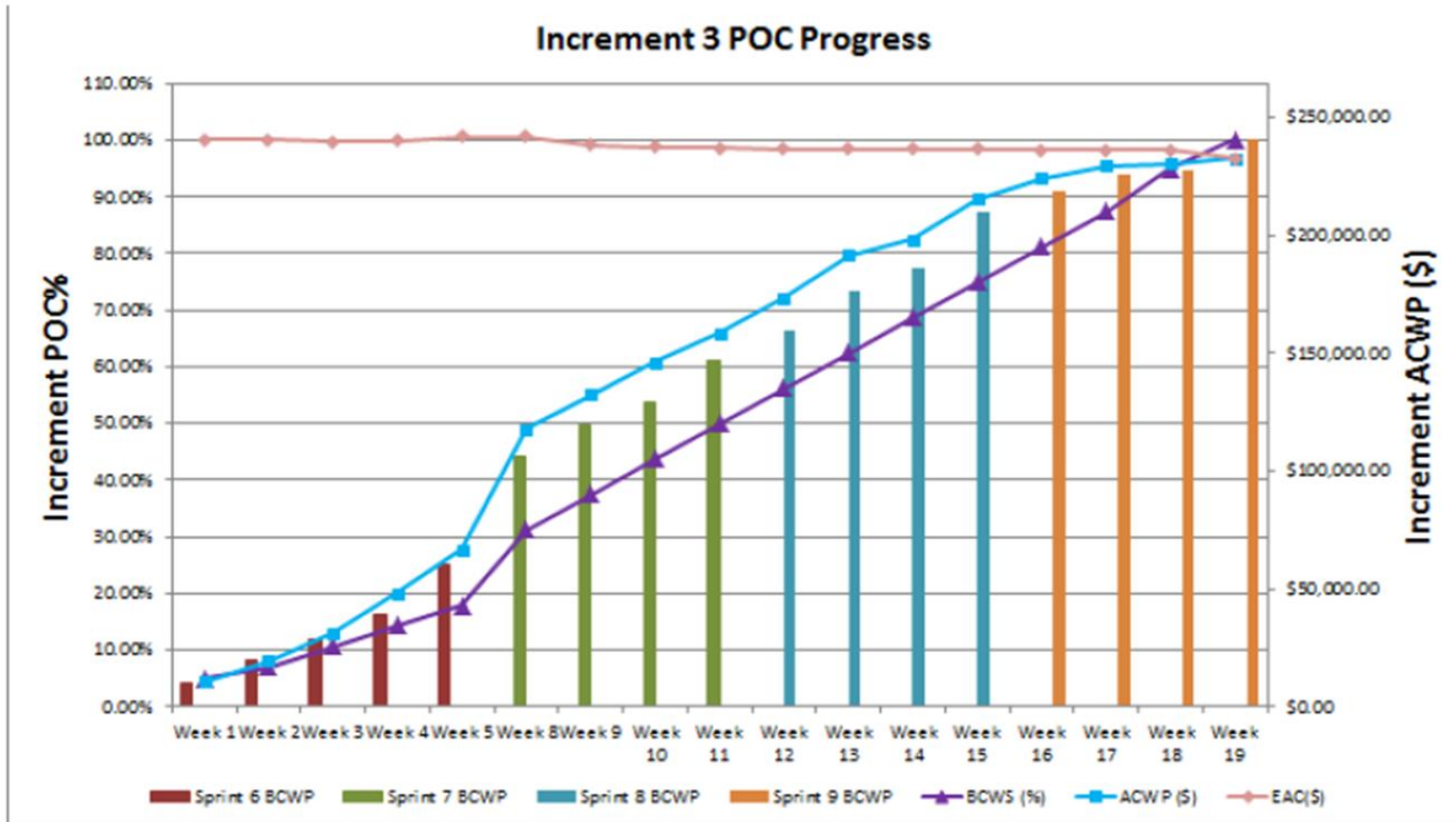


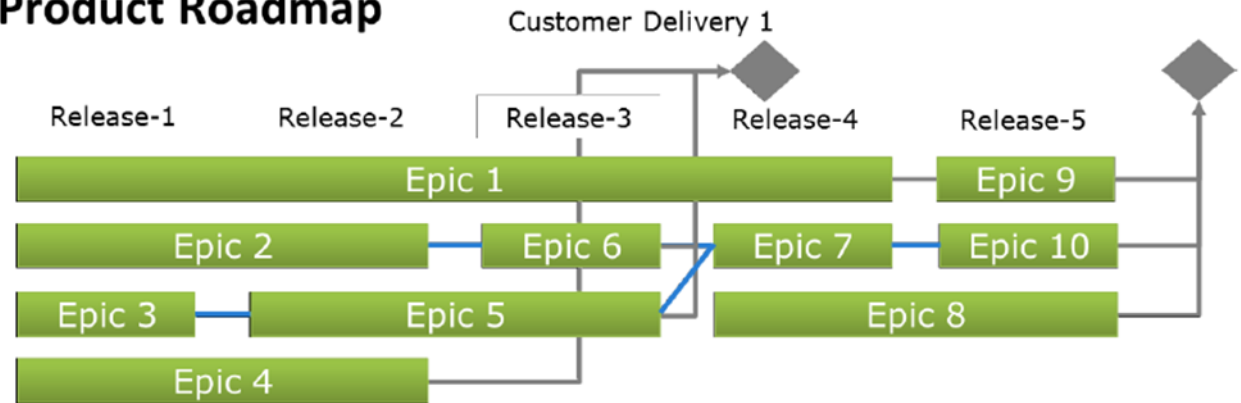
Figure 11: Example of a progress tracking report indicating both Agile and EVM progress data on graph.

Appendix D

**PRODUCT ROADMAP, RELEASE
PLANNING, AND ROLLING WAVE
PLANNING PRODUCTS**

Roadmap Creation

Product Roadmap



Product backlog

- Full scope of work
- Backlog items *include sizing* information

Product Roadmap provides

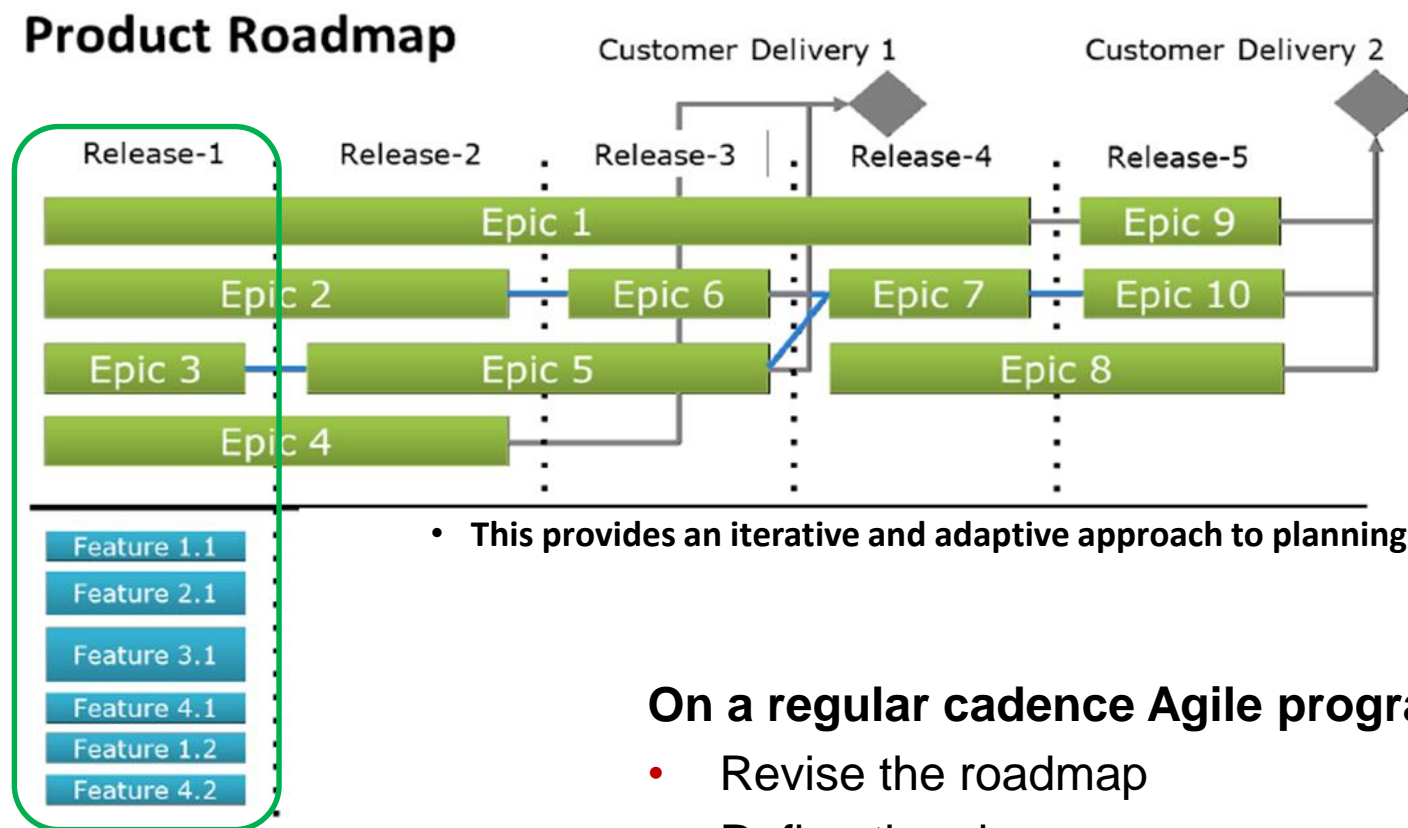
- High level
- Time-phased
- Priority based
- Aligned to customer milestones
- Framework for the PMB and IMS

Roadmap is developed

- Program start
- Refined through time

Agile Release Planning Cadence

Product Roadmap



On a regular cadence Agile programs

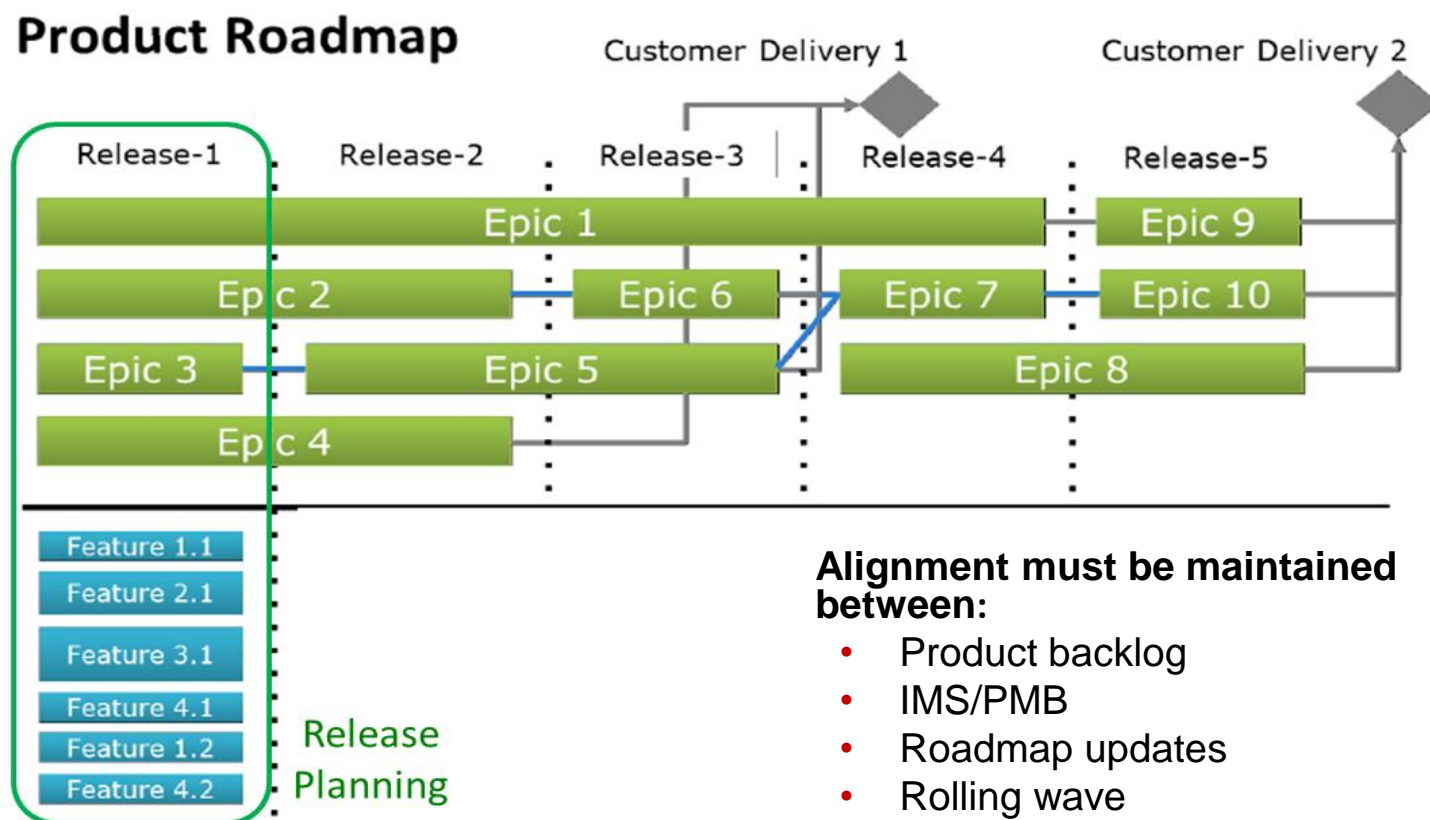
- Revise the roadmap
- Refine the plan
- Decompose work

Rolling Wave Planning

Rolling Wave Planning aligns with Agile Release Planning cadence

- Update PMB
- Maintain IMS in accordance to change management plan

Product Roadmap

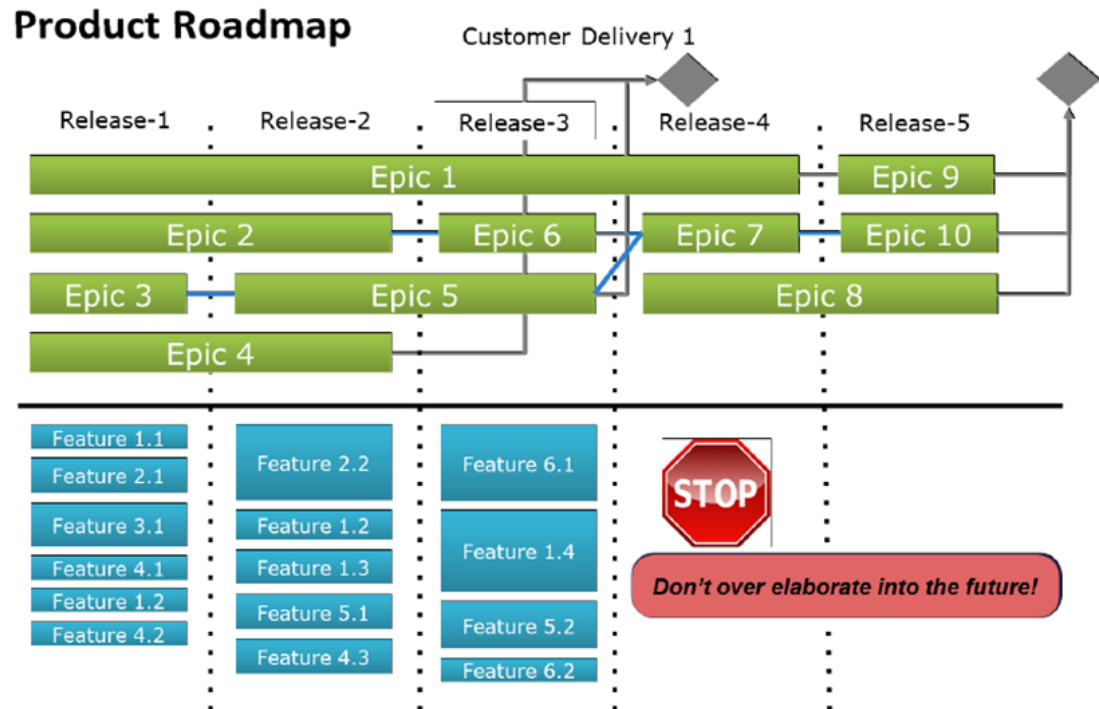


Roadmap Depth of Detail

It is often appropriate, at both roadmap creation and release planning to decompose *some* Epics into Sub-Epics and Features in future releases

Key points

- Only decompose where appropriate and needed
- Not all Epics will be decomposed to the same degree
- Level of decomposition may vary
- Features planned for future releases may require further refinement or decomposition before implementation



Potential Planning Challenges

Roadmap Maintenance

- Ongoing process of updates, at least in alignment with release cadence
- Always reflect current truth

Mapping / movement of scope (Epics & Features) and budget.

- Product Backlog must reflect full program scope
- Mapped to work packages and planning packages
- If product moves budget must go with it

IMS Maintenance (Freeze Period baseline change control).

- Rolling wave and contractor defined freeze period
- Detail plan must be approved prior to the start of work
- Timing of planning and rolling wave can create challenges with “just in time” planning

Strike a balance

The flexibility of Agile, while maintaining integrity of cost, schedule, budget baseline.

Appendix E

IBR CONSIDERATIONS

IBR Considerations

- The purpose of the IBR Considerations Appendix within the NDIA Agile EVM Guide is to provide the program reviewer with a list of artifacts and processes that can be used to augment standard IBR artifacts when evaluating programs implementing Agile methods.
- This Appendix is not a comprehensive IBR checklist, but is limited to items that support the portions of the plan related to Agile methods
- The information provided prompts the IBR reviewer on areas to explore and questions to ask when looking at Agile artifacts in relation to evaluating the soundness of the program plan