

# EVMS Planning and Execution for Agile Projects

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# Agenda

- **Agile Planning**
  - Agile Planning and Planning Levels
  - Traditional / Agile Planning Comparison
  - Agile Planning and the Product Backlog
  - Budget Determination
  - Release Planning and Rolling Wave Planning
  - Inchstone Definition using Stories
  - Agile Planning Summary
- **Agile Execution**
  - Calculating Earned Value
  - Release Burndown
  - Early or Late Story Completion
  - Adding or Removing Stories
- **Summary**
- **Agile Planning Checklist**
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# EVMS Implementation for Agile Projects

## Planning

# Agile Planning

- Agile projects plan and execute in accordance with established EVMS policies, procedures and guidelines
- Agile Planning is **value driven**: the value of the Features to the customer drives the order of work
- Therefore, Agile Planning is Feature-Based rather than Activity-Based
  - Feature examples: shoot a missile, track a target, establish comm circuit
  - Activity examples: write requirements, update design, write code, run unit tests
- Agile Planning Terms:
  - **Capability**: customer-required ability of the system that provides value to the warfighter
  - **Feature**: part of a capability which can be completed within an incremental release (e.g. 3 – 6 months)
  - **Story**: part of a Feature which can be complete within one iteration (2-4 wks)

# Agile Planning Levels

Agile Planning levels related to Agile EVMS<sup>1</sup>:

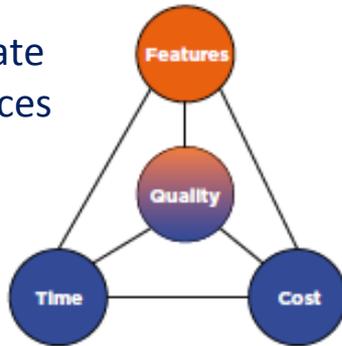


Planning Level	Planning Frequency	Planning Horizon	Planning Precision	Planning Artifact
Product Planning	Project startup; updates throughout the project	Project Duration	Capabilities	Product Backlog; Product Roadmap
Release Planning	Each incremental release/rolling wave	Incremental Release	Features/ Stories	Release Plan
Iteration (Sprint) Planning	Each iteration or sprint	Weeks	Stories/ Tasks	Sprint Backlog
Daily Planning	Daily	Day	Tasks	Updated Sprint Backlog

<sup>1</sup> A fifth planning level, **Vision Planning**, which occurs prior to Product Planning, is not included in this training. See reference 1 for more information on Vision Planning.

# Traditional / Agile Planning: A Comparison

Traditional Approach

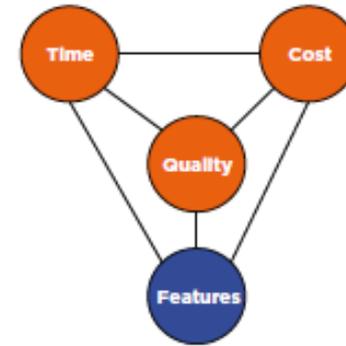


fix scope, estimate  
time and resources

Fixed

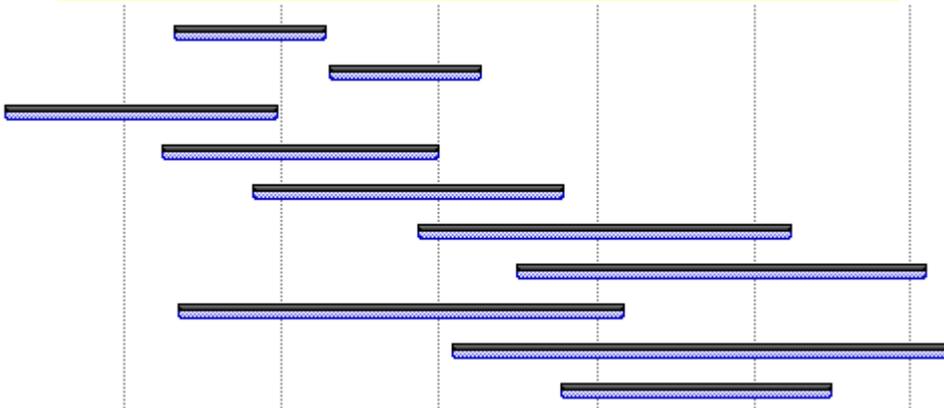
Variable

Agile Approach

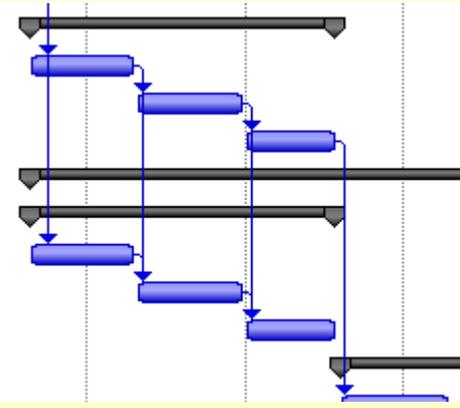


fix date and  
resources,  
estimate scope

Duration and resources are a function of Scope



Scope is a function of duration and resources

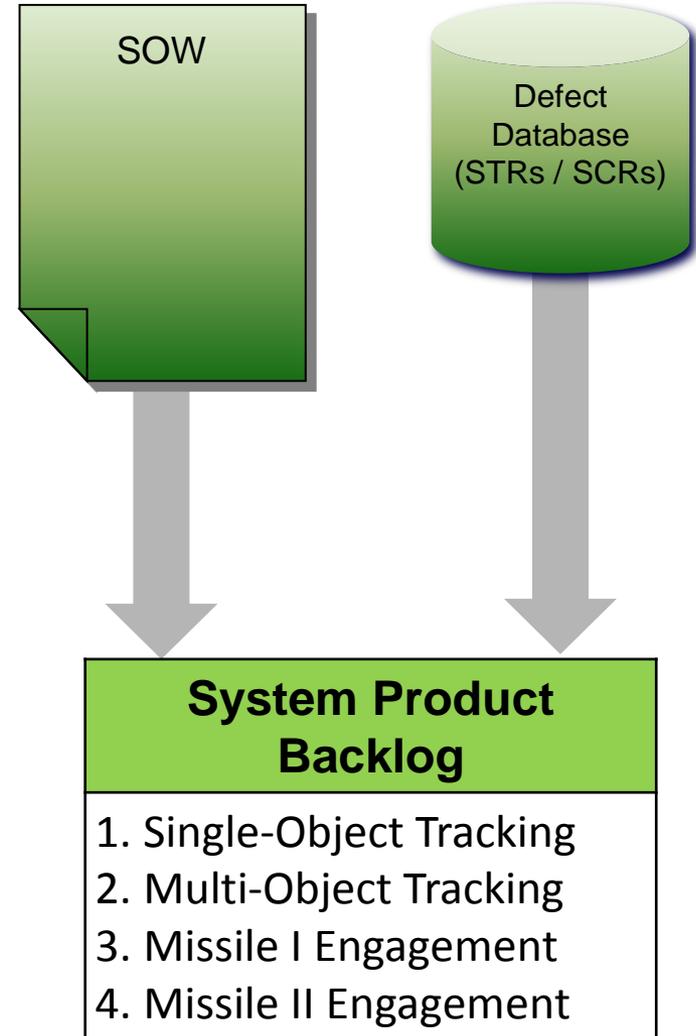


Manage Cost through regular Scope vs Cost analysis

# Agile Planning: Product Planning System Product Backlog

## System Product Backlog

- Prioritized List of Features of value to the customer
- Comprises the total technical scope of the delivered system
- Includes uncorrected defects (technical debt)
- Managed by **Product Owner**
- Constitutes Product Owner's direction to the scrum team
- Serves as basis for System-Level Integration and Acceptance Testing
- Is a list of Features, not development tasks



# Agile Planning: System/Team Product Backlog & Product Roadmap

System Product Backlog	Display SW Backlog	Comms SW Backlog	Mission SW Backlog
Single-Object Tracking (SOT)	SOT Displays	SOT Comms	SOT Radar Control
Multi-Object Tracking (MOT)	MOT Displays	MOT Comms	MOT Radar Control
Missile I Engagement	Missile I Displays	Missile I Comms	Missile I Radar Control
Missile II Engagement	Missile II Displays	Missile II Comms	Missile II Radar Control

Each System Backlog Feature is decomposed into SW-specific Features using system-level analysis (e.g. threads or integration test cases)

Each SW Product Backlog consists of a prioritized list of SW-specific Features.

### SW Product Roadmaps

- Assign SW Backlog Features to Releases
- Use Feature estimates to balance effort across releases

**System Product Roadmap**  
Assign System Backlog Features to Releases

System Product Roadmap	
Release 1	Release 2
Single-Object Tracking	Missile I Engagement
Multi-Object Tracking	Missile II Engagement

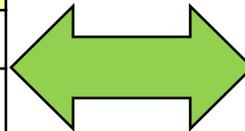
System Capabilities achieved through completion of the SW-specific Features comprising each System Capability

Display SW Product Roadmap	
Comms SW Product Roadmap	
Mission SW Product Roadmap	
Release 1	Release 2
SOT Radar Control	Missile I Radar Control
MOT Radar Control	Missile II Radar Control

# Agile Planning: Product Planning Budget Determination

Technical Scope  
(by Release)

Mission SW Product Roadmap	
Release 1	Release 2
SOT Radar Control	Missile I Radar Control
MOT Radar Control	Missile II Radar Control



Development Budget  
(by Release)

	Release 1	Release 2
Lines of Code	12,000	15,000
Productivity	2.00	2.25
Hours	6000	6667
Rate	\$23	\$24
BAC	<b>\$137K</b>	<b>\$160K</b>

# Agile Planning: Release Planning

## Release Plan

System Product Roadmap	
Release 1	Release 2
Single-Object Tracking	Missile I Engagement
Multi-Object Tracking	Missile II Engagement

Display Team
Comms Team
Mission Team
Release 1
SOT Radar Control
MOT Radar Control

**Confirm release scope**  
features planned for the release at the system and team level

The number of sprints is based on sprint length and release duration

System-Level Integration drives feature priority

Display Team – Release 1 Plan						
Comms Team – Release 1 Plan						
Mission Team – Release 1 Plan						
Sprint 1	Sprint 2	Sprint 3	Sprint 4	Sprint 5	Sprint 6	
SOT Initiation		SOT closeout		MOT Maintenance		
SOT Maintenance		MOT Initiation		MOT Closeout		
Story 1	Story 5	Story 8	Story 10	Story 12 Story 13		
Story 2	Story 6	Story 11				
Story 3	Story 7	Story 9				
Story 4						

**Establish milestone scope**  
decompose release-level features to scope that can be completed within milestone duration. Balance milestone scope, duration and budget.

Define & estimate user stories to the extent needed to define milestone scope. Near-team Stories are sized to complete in one sprint.

**Release Planning Provides Milestone Scope Definition for Rolling Wave Planning**

# Agile Planning: Rolling Wave Planning

## Release Planning

- Conducted prior to rolling wave planning
- Establish **Release Scope**: features planned for the release

Mission SW Release 1 Release Scope
Single-Object Track Radar Control
Multi-Object Track Radar Control

- Establish **Milestone Scope**: features planned for each milestone.

Mission SW Release 1 Milestones
<b>Milestone 1</b>
Single-Object Track Initiation
Single-Object Track Maintenance
<b>Milestone 2</b>
Single-Object Track Closeout
Multi-Object Track Initiation
<b>Milestone 3</b>
Multi-Object Track Maintenance
Multi-Object Track Closeout

## Rolling Wave Planning

- Use milestones weight with percent complete (MWPC) earned value technique (EVT)
- Work Package period of performance aligns with sprint boundaries (beginning of 1<sup>st</sup> sprint; end of last sprint).
- Milestone scope is the features planned for the milestone
- Work Package scope is the features planned for the release
- Work packages and milestone budget determined from feature scope.

EV Level	Task Name	Start	Finish	BCWS
CA	[-] Mission SW Development	Tue 5/28/13	Wed 4/2/14	\$234
WP	[-] Mission SW Eng Release 1 SOT and MOT DCTI	Tue 5/28/13	Fri 11/8/13	\$137
milestone	SOT Initiation and Maintenance	Tue 5/28/13	Fri 7/19/13	\$45
milestone	SOT Closeout; MOT Initiation	Mon 7/22/13	Fri 9/13/13	\$45
milestone	MOT Maintenance and Closeout	Mon 9/16/13	Fri 11/8/13	\$46

- Inchstones are used MWPC EV reporting.
  - EVMS Manual 10255:

*Milestone Weights with Percent Complete: This method is similar to Milestone Weights, where milestones are logically sequenced and descriptions have sufficient clarity to stand alone to determine completion or accomplishment. This technique differs from Milestone Weights in that it also allows for recognition of partial performance if a Milestone is not yet 100% complete. To status the WP, the CAM uses the milestone criteria to determine complete or not, and, if not 100% complete, **values for percent complete of the milestone is based on CAM assessment of work accomplished** or subordinate detail. Any earned value milestone with task duration greater than two accounting periods requires subordinate detail to limit the subjectivity for the work-in-process assessment. **CAM controlled planning of the milestone into “inchstones” with defined values is one common method used for work-in-process assessments**, if the technical basis of the work does not already have a predetermined methodology (e.g. IPDS work products or steps). (emphasis added)*

# Agile Planning: Inchstones Definition

EV Level	Task Name	Start	Finish
CA	[-] Mission SW Development	Tue 5/28/13	Wed 4/2/14
WP	[-] Mission SW Eng Release 1 SOT and MOT DCTI	Tue 5/28/13	Fri 11/8/13
milestone	SOT Initiation and Maintenance	Tue 5/28/13	Fri 7/19/13
milestone	SOT Closeout; MOT Initiation	Mon 7/22/13	Fri 9/13/13
milestone	MOT Maintenance and Closeout	Mon 9/16/13	Fri 11/8/13

Use of Story points weights is the "defined value" used to calculate milestone percent complete

- **Stories** are used as inchstones for earned value reporting to reinforce value of **working software** over completion of engineering tasks
- Inchstones are not IMS tasks and therefore have no budget, scope or schedule assigned to them
- Story point weightings are used to calculate the earned value contribution of each completed story

Inchstones	Weight
<b>SOT Initiation and Maintenance</b>	<b>39</b>
Schedule verify waveform	3
Correlate verify detection w/ search detection	3
Schedule TI pulse pair	8
schedule track maint waveform	8
validate detection	2
associate detection with track	3
update 6-state KF	2
update 9-state KF	8
update track rate	2

# Agile Planning: Summary

## EV Baseline (subject to BCR)

- Work Package and milestone scope baselined at rolling wave; revised only with BCR
- **Work Package** scope equals the features planned for the release
- **Milestone** scope equals features planned for the milestone

EV Level	Task Name	Start	Finish
	Project Start	5/28/13	5/28/13
CA	<input type="checkbox"/> Mission CSCI Development	5/28/13	4/2/14
WP	<input type="checkbox"/> Mission CSCI Eng Release 1 SOT and MOT DCTI	5/28/13	11/8/13
milestone	SOT Initiation and Maintenance	5/28/13	7/19/13
milestone	SOT Closeout; MOT Initiation	7/22/13	9/13/13
milestone	MOT Maintenance and Closeout	9/16/13	11/8/13

## Supporting Data for Milestones (not subject to BCR)

modified at the discretion of the team to achieve milestone scope

- **Stories** are used as inchstones for earned value reporting to reinforce value of **working software** over completion of engineering tasks
- Inchstones are not IMS tasks and therefore do not require budget, scope or schedule assigned to them
- Story point weightings are used to calculate the earned value contribution of each completed story

Inchstones	Weight
<b>SOT Initiation and Maintenance</b>	<b>39</b>
Schedule verify waveform	3
Correlate verify detection w/ search detection	3
Schedule TI pulse pair	8
schedule track maint waveform	8
validate detection	2
associate detection with track	3
update 6-state KF	2
update 9-state KF	8
update track rate	2

# EVMS Implementation for Agile Projects Execution

# Agile Execution: Calculating Earned Value

## Status at end of Sprint 2:

Inchstones	Weight	Status	Earned
<b>SOT Initiation and Maintenance</b>	<b>39</b>	<b>S</b>	<b>31</b>
Schedule verify waveform	3	F	3
Correlate verify detection w/ search detection	3	F	3
Schedule TI pulse pair	8	F	8
schedule track maint waveform	8	F	8
validate detection	2	F	2
associate detection with track	3	F	3
update 6-state KF	2	NS	0
update 9-state KF	8	S	4
update track rate	2	NS	0

Half of story weight is earned when the story is started and half when the story is finished.

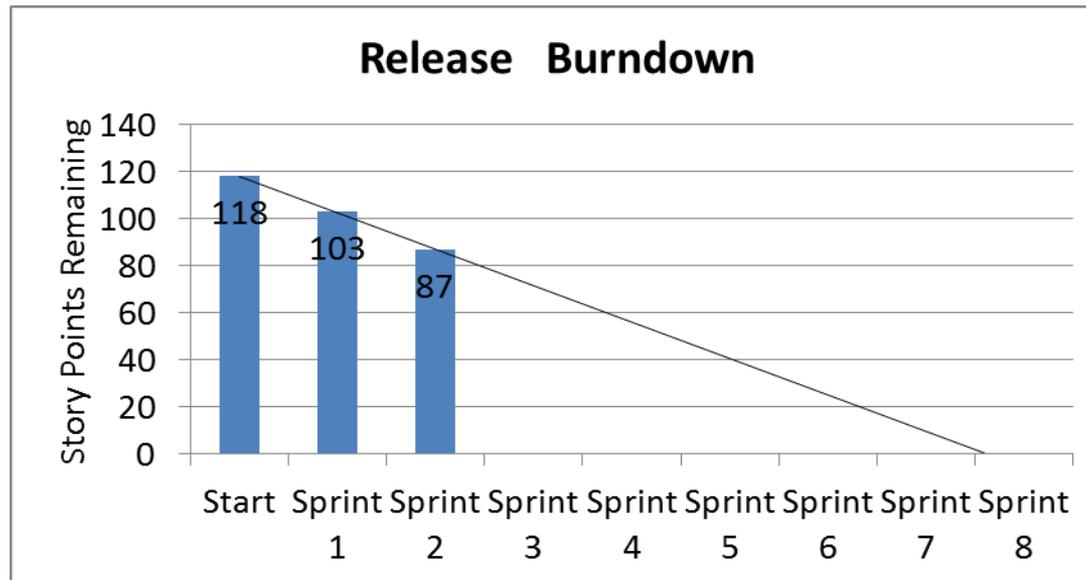
Legend: NS = not started; S = started; F = finished

Total story points earned is used to calculate milestone percent complete used for earned value reporting

	Description	Weight	Earned	EV %
WP	<b>Mission SW Eng Release 1 SOT and MOT DCTI</b>	118	<b>31</b>	26%
milestone	SOT Initiation and Maintenance	39	31	79%
milestone	SOT Closeout; MOT Initiation	39	0	0%
milestone	MOT Maintenance and Closeout	40	0	0%

# Agile Execution: Release Burndown

Status at end of Sprint 2:



- The Release Burndown shows the number of story points remaining at the end of each sprint.
- The Release Burndown is a **leading indicator of schedule performance**
- In this example:  $SPI = 31/39 = 0.79$
- Outlook completion:  $6 \text{ sprints} / 0.79 = 8 \text{ sprints}$

# Agile Execution: Starting Stories Early

## Status at end of Sprint 2:

	Weight	Status	Earned
<b>SOT Initiation and Maintenance</b>	<b>39</b>	<b>F</b>	<b>39</b>
Schedule verify waveform	3	F	3
Correlate verify detection w/ search detection	3	F	3
Schedule TI pulse pair	8	F	8
schedule track maint waveform	8	F	8
validate detection	2	F	2
associate detection with track	3	F	3
update 6-state KF	2	F	2
update 9-state KF	8	F	8
update track rate	2	F	2

SOT Initiation and Maintenance  
Milestone Complete

Inchstones	Weight	Status	Earned
<b>SOT Closeout; MOT Initiation</b>	<b>39</b>	<b>S</b>	<b>2</b>
Story 8a	2	S	1
Story 8b	2	S	1
Story 9a	5	NS	0
Story 9b	8	NS	0
Story 10a	3	NS	0
Story 10b	3	NS	0
Story 10c	5	NS	0
Story 11a	8	NS	0
Story 11b	3	NS	0

Second milestone starts early.  
Stories associated with SOT  
Closeout; MOT Initiation started early  
but remained with that milestone

IMS update shows early finish  
and early start

Description	Plan Start	Plan Finish	Actual Start	Actual Finish	Weight	Earned	EV %
<b>Mission SW Eng Release 1 SOT and MOT DCTI</b>	5/28/13	11/8/13	5/28/13		118	41	35%
SOT Initiation and Maintenance	5/28/13	7/19/13	5/28/13	7/12/13	39	39	100%
SOT Closeout; MOT Initiation	7/22/13	9/13/13	7/15/13		39	2	5%
MOT Maintenance and Closeout	9/16/13	11/8/13			40	0	0%

**NOTE:** If a started story implements scope outside the WP, you need to open a new WP

# Agile Execution: Finishing Stories Late

## Status at end of Sprint 2:

Inchstones	Weight	Status	Earned
<b>SOT Initiation and Maintenance</b>	<b>39</b>	<b>S</b>	<b>34</b>
Schedule verify waveform	3	F	3
Correlate verify detection w/ search detection	3	F	3
Schedule TI pulse pair	8	F	8
schedule track maint waveform	8	F	8
validate detection	2	F	2
associate detection with track	3	F	3
update 6-state KF	2	F	2
update 9-state KF	8	S	4
update track rate	2	S	1

SOT Initiation and Maintenance milestone incomplete

Incomplete stories are planned for a subsequent sprint but remain with the SOT Initiation and Maintenance milestone.

Inchstones	Weight	Status	Earned
<b>SOT Closeout; MOT Initiation</b>	<b>39</b>	<b>NS</b>	<b>0</b>
Story 8a	2	NS	0
Story 8b	2	NS	0
Story 9a	5	NS	0
Story 9b	8	NS	0
Story 10a	3	NS	0
Story 10b	3	NS	0
Story 10c	5	NS	0
Story 11a	8	NS	0
Story 11b	3	NS	0

IMS update shows late finish

Description	Plan Start	Plan Finish	Actual Start	Outlook Finish	Weight	Earned	EV %
<b>Mission SW Eng Release 1 SOT and MOT DCTI</b>	5/28/13	11/8/13	5/28/13		118	34	29%
SOT Initiation and Maintenance	5/28/13	7/19/13	5/28/13	8/16/13	39	34	87%
SOT Closeout; MOT Initiation	7/22/13	9/13/13	7/22/13	10/11/13	39	0	0%
MOT Maintenance and Closeout	9/16/13	11/8/13			40	0	0%

# Agile Execution: Adding and Removing Stories

- Following Release Planning the Scrum team may need to add stories to or remove stories from the product backlog to implement certain features. Stories added to or removed from the product backlog should be added to or removed from the inchstones for the applicable milestone.
- Inchstones may be changed without a BCR as long as:
  - added stories are related to the features that comprise the scope of the associated milestone
  - removed stories are not necessary to complete the scope of the associated milestone.

# Agile Execution: Adding a Story

Inchstones	Weight	Status	Earned
<b>SOT Initiation and Maintenance</b>	<b>47</b>	<b>S</b>	<b>31</b>
Schedule verify waveform	3	F	3
Correlate verify detection w/ search detection	3	F	3
Schedule TI pulse pair	8	F	8
schedule track maint waveform	8	F	8
validate detection	2	F	2
associate detection with track	3	F	3
update 6-state KF	2	NS	0
update 9-state KF	8	S	4
correlate pulse pair detections with verify detections	8	NS	0
update track rate	2	NS	0

The team determined that “correlate pulse pair detections” story was needed to complete the milestone so they added the story and its associated story point estimate to the Product Backlog and EV reporting sheet. Addition of the story correctly resulted in a decrease in milestone % complete, since the remaining effort was increased.

EOC	Description	Weight	Earned	EV %
WP	<b>Mission SW Eng Release 1 SOT and MOT DCTI</b>	126	31	25%
subtask	SOT Initiation and Maintenance	<b>47</b>	31	<b>66%</b>
subtask	SOT Closeout; MOT Initiation	39	0	0%
subtask	MOT Maintenance and Closeout	40	0	0%

was  
39

was  
87%

# Agile Execution: Removing a Story

Inchstones	Weight	Status	Earned
<b>SOT Initiation and Maintenance</b>	<b>31</b>	<b>S</b>	<b>29</b>
Schedule verify waveform	3	F	3
Correlate verify detection w/ search detection	3	F	3
Schedule TI pulse pair	8	F	8
schedule track maint waveform	8	F	8
validate detection	2	F	2
associate detection with track	3	F	3
update 6-state KF	2	F	2
update track rate	2	NS	0

The team determined that “update 9-state KF” story was not needed to complete the milestone so they removed the story and its associated story point estimate from the Product Backlog and EV reporting sheet. Removal of the story correctly resulted in a increase in milestone % complete, since the remaining effort was decreased.

EOC	Description	Weight	Earned	EV %
WP	<b>Mission SW Eng Release 1 SOT and MOT DCTI</b>	110	29	26%
subtask	SOT Initiation and Maintenance	<b>31</b>	29	<b>94%</b>
subtask	SOT Closeout; MOT Initiation	39	0	0%
subtask	MOT Maintenance and Closeout	40	0	0%

was  
39

was  
87%

# Summary

- Agile projects plan and execute in accordance with established EVMS policies, procedures and guidelines
- Agile promotes a strong, continuous planning discipline with the right level of precision for each planning time-horizon under consideration.
- Agile Planning is Feature-Based rather than Activity-Based to reinforce the importance of focusing on customer value.
- Product Planning establishes the initial product backlog and product roadmap and provides details needed to complete the initial IMS baseline and establish the PMB
- Release Planning establishes milestone scope sufficient to perform Rolling Wave Planning
- Work package scope is features planned for the release
- Milestone scope is features planned for the milestone

# Summary

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- Stories comprise the inchstones for EV reporting
- Inchstones are not IMS tasks and therefore have no budget, scope or schedule related to them
- The Release Burndown is a leading indicator of schedule performance.
- When starting stories early or finishing stories late, the sprint in which a story is completed may change but the story remains associated with the milestone for which it is required
- Adding or removing stories requires no changes to the EV baseline so long as the milestone scope is not impacted

# Agile Planning Checklist

- Agile Planning Checklist
  - Product Planning
    - Product Backlog consists of Features of value to the customer
  - Release Planning:
    - WP and milestone scope established from the Product Roadmap and expressed as features of the system recognized as capabilities of value to the customer
    - Stories identified to the extent needed to establish appropriate scope for each milestone
    - Story points per Sprint (velocity) consistent with team composition and historical performance
  - IMS Planning
    - Budget established at WP level using product size estimates (e.g. SLOC) and productivity
    - Work package scope is features planned for the release
    - Milestone scope is features planned for the milestone
    - Work packages and milestone names are the release and milestone features

# References / Contact Info

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## References

1. Software Project Manager's Bridge to Agility, Sliger and Broderick, 2008
2. Agile EVM – Earned Value Management in Scrum Projects, Sulaiman et al., 2006
3. Agile Estimating and Planning, Mike Cohn, 2006
4. Manual 10255, Raytheon Company Earned Value Management Systems Process Description

## Contact

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