



---

# Cost Estimating Issues for MAIS Programs Using an Agile Approach for SW Development

**22 September 2015**

**Presented by  
Richard Mabe**

**Tech Advisor, IT and Electronics Division  
AF Cost Analysis Agency**

*(MAIS Working Group Chair , supporting the  
CADE Senior Steering Group,  
OSD CAPE)*

---

# Foreword

---

- **This presentation includes ideas and view points gathered from several sources:**
    - **SW and Info Systems Cost IPT**
    - **MAIS Working Group**
    - **SRDR Working Group**
    - **GAO Expert Meetings**
    - **SME Experience (Service Cost Agencies; PEO and PMO Staffs)**
  - **None of the information is proprietary**
  - **It has been peer reviewed and adjusted to reflect a set of “working” concepts for discussion**
-

# Scope and Definitions

## • What is a MAIS Program?

### From DODI 5000.02, Table 1:

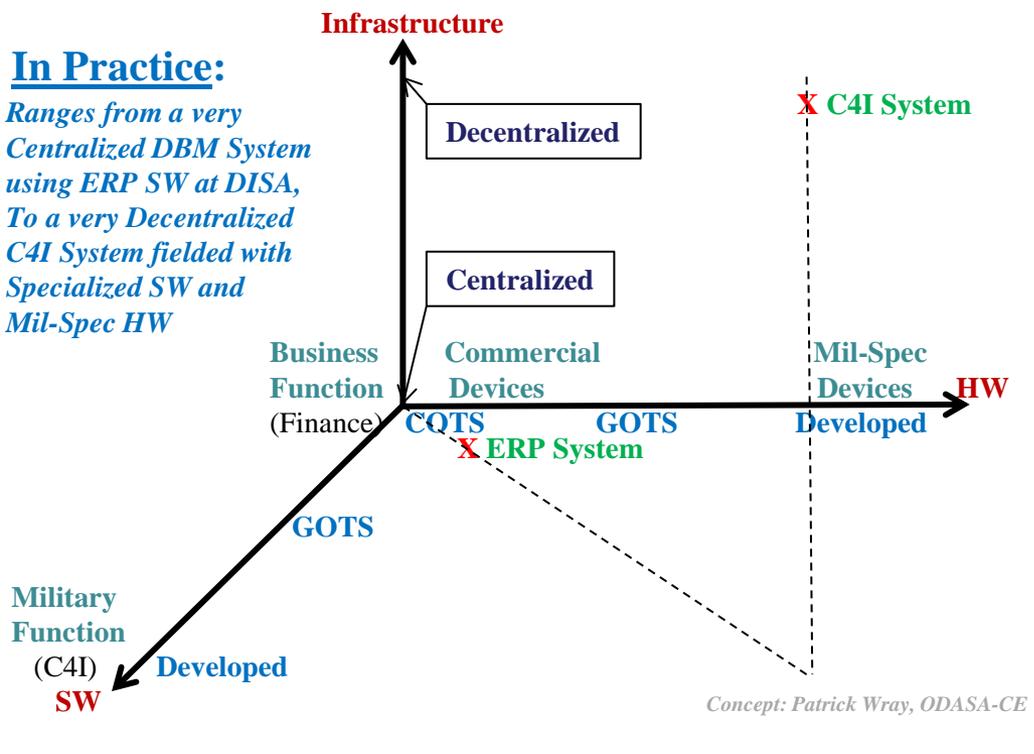
- ACAT 1AM or ACAT 1AC
- >\$40M\* (CY14) in any FY
- >\$165M\* through deployment
- >\$520M\* for Life Cycle
- SW Intensive; Incremental^
- Information Technology Systems
- Defense Business Systems

(\*Note 1: Includes all appropriations, regardless of fund source.)

(^Note 2: Program Increments may be treated as separate acquisition programs (Ref. Fig 5)).

### In Practice:

*Ranges from a very Centralized DBM System using ERP SW at DISA, To a very Decentralized C4I System fielded with Specialized SW and Mil-Spec HW*



- Not all Software is developed for a MAIS Program, but all MAIS Programs include significant Software development/ configuration/ COTS integration/ new object enhancements/ etc .....

# “Cost” Compared to “Earned Value”

<b>Cost</b>	<b>Common</b>	<b>Earned Value</b>
Unconstrained		Budget Constrained
Life Cycle Estimate	Schedule (IMS) Program Plan	Schedule Centric Plan
Based on history, analogies or engineering buildup, factors, CERs	SW Labor SEPM Labor IAT Labor	Based on known Work Packages and future Planned Effort
Reported in dollars, but estimate = $f(\text{Cost, Schedule and Technical Data})$		Reported in dollars, even for Schedule variance; No Technical Measures (e.g., SW progress related to SW Size)
Used for budget estimating, cost trade-off studies and other support		Used to evaluate and track budget and schedule performance
Includes uncertainty related to the tech data and cost models	SW Size/Scope SW Quality Productivity	Incorporates the Vendor’s perceived project risk/reserve
Based on a Program WBS	Mil-Std-881C WBS Items	Based on a Contract WBS

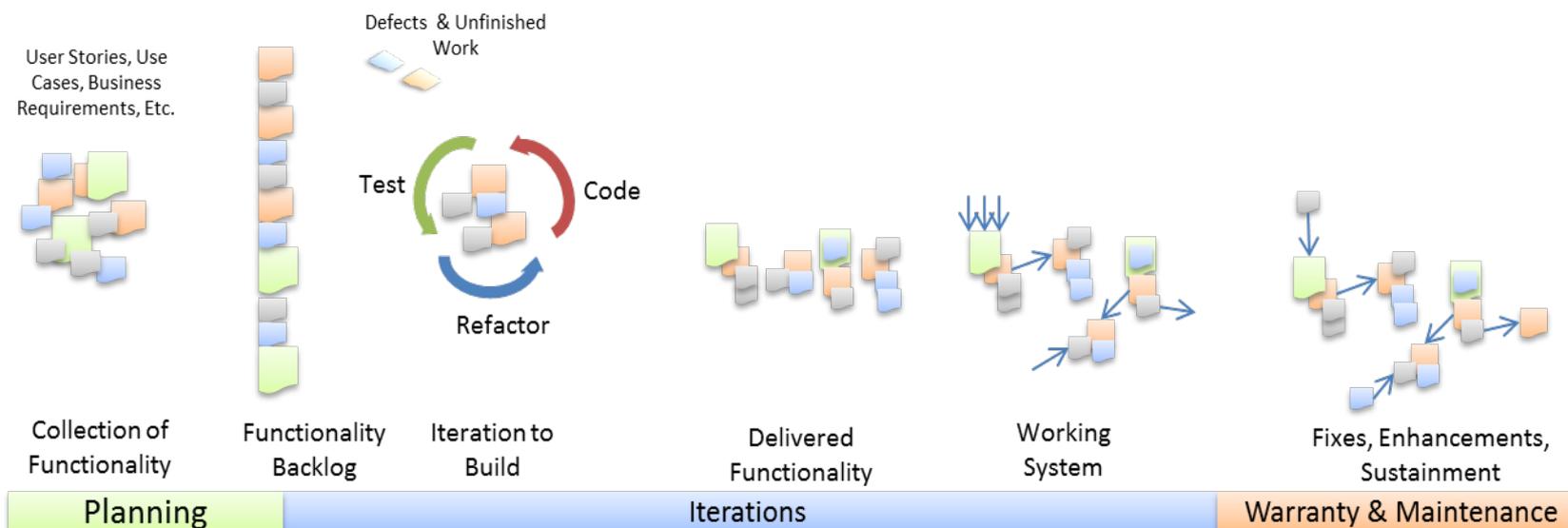
**Issues related to Agile affect the Common Ground between Cost and EVM**

---

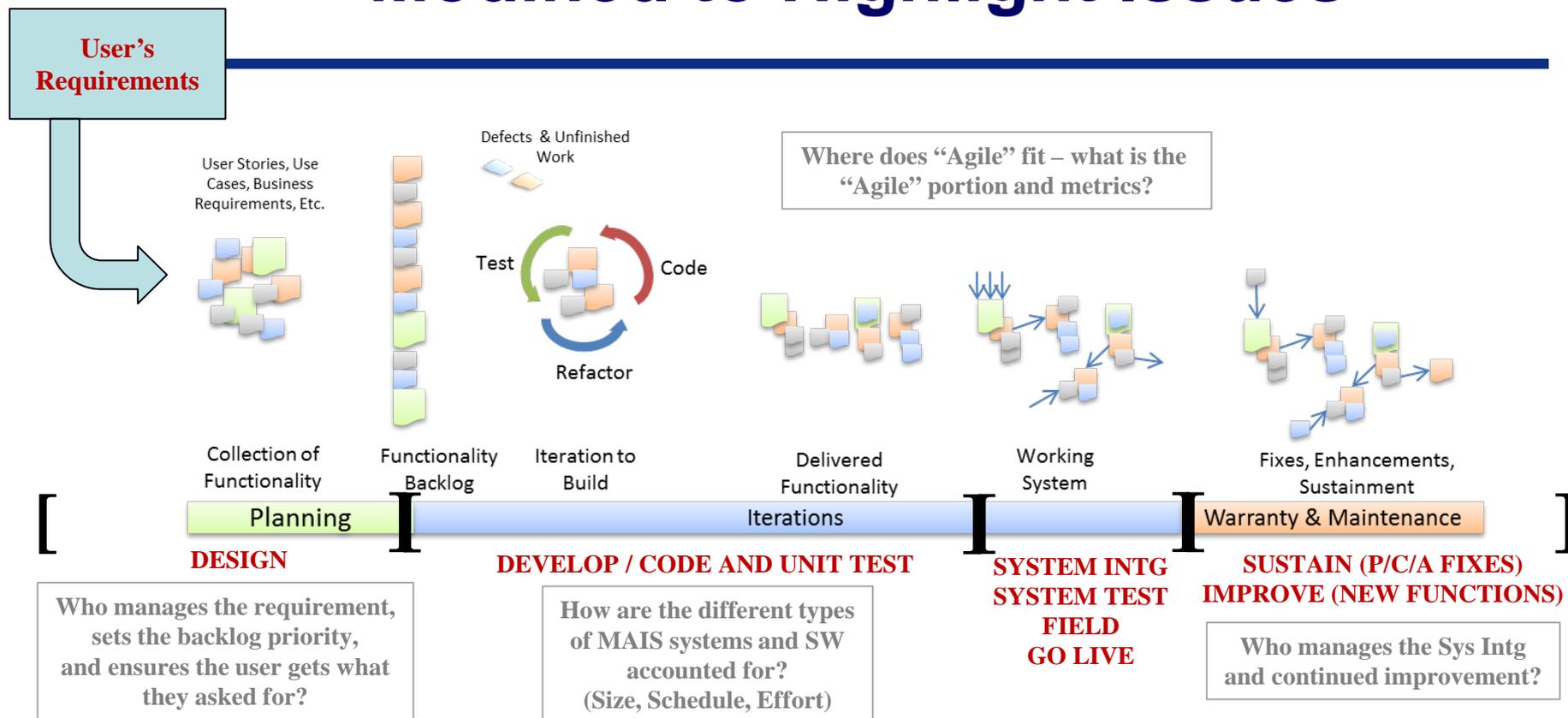
# **Discussion of the “Issues” (Not all Issues are Problems)**

# Agile Process

- Focus is on what features can be delivered per iteration
- Not fully defined what functionality will be delivered at the end of each Iteration
- Full Working System functionality likely requires multiple iterations



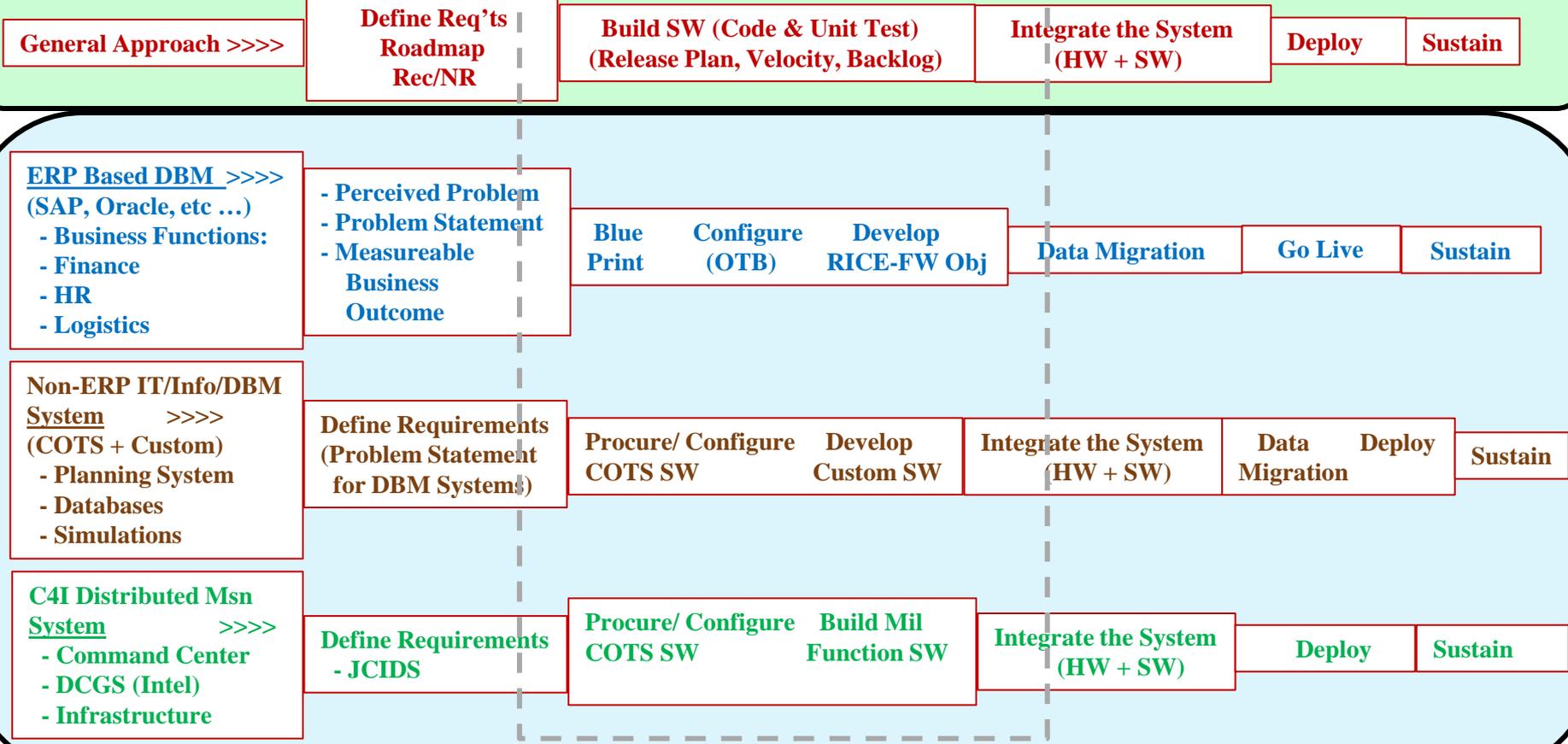
# Modified to Highlight Issues



- **“Working System” = Sum of the Iterations, following System Level Integration and Testing**
- **Iterations do not align with Delivered SW functional “End Items” specified by User Requirement**
- **Iterations do not align with EVM Work Packages – which may or may not match SW End Item**
- **Backlog is inherently stacked by priority – or by need-at-the-moment – or by what?**
- **Lines between the SW Team, Systems Engineers, Contractor PM and Gov’t PM are squishy**

# Issues

## ISSUE 1: WHERE DOES AGILE ACTUALLY “FIT” IN THE COST WBS / MODEL?



DOES AGILE EXTEND BEYOND THE SW PORTION OF THE PRIME SYSTEM? HOW FAR?

# Issues

## ISSUE 2: HOW IS THE AGILE PORTION SCALED, MEASURED AND ESTIMATED (LIFE CYCLE COST; ESTIMATE AT COMPLETE)? – BEST PRACTICES:

### MEASURING THE SW EFFORT

<u>SIZE</u>	<u>PRODUCTIVITY</u>	<u>SCHEDULE</u>
COUNT “SHALLS”		ROAD MAP
SLOC/ESLOC	HOURS/SLOC	MILESTONES/
CONFIGURATIONS	HOURS/ITEM	SDP
RICE-FW OBJECTS	HOURS/OBJECT	
FUNCTION POINTS	HOURS/ITEM	
	<u>VELOCITY</u>	
USER STORIES	HOURS/SP	BACKLOG
STORY POINTS	SP/SPRINT	BURN DOWN RATE

### CHARACTER OF THE DELIVERED SW PRODUCT

(End Item Oriented)  
 SW END ITEM (CPEI)  
 CONFIGURED ERP OBJECTS  
 DEVELOPED OBJECTS

(Release Oriented)  
 RELEASE =  $\Sigma$  Iterations  
 (Features, Epics)

### SUSTAIN THE DELIVERED SW PRODUCT

MAINTENANCE RELEASE  
 - ADAPTIVE/CORRECTIVE/  
 PREVENTIVE  
 - NEW CAPABILITY  
 UPGRADE COTS/ERP

MAINTENANCE RELEASE

# Issues

---

## ISSUE 3: COLLECTING DATA AND MANAGING DATA TO INFORM FUTURE ESTIMATES.

### UPDATES IN-WORK FOR KEY REPORTING FORMATS; DATA TO BE STORED IN COST ANALYSIS DATA ENTERPRISE CADE)

- **CSDR PLAN (FORM 2794):** Commodity specific WBS (Mil-Std-881C, Appendix K); Specified reporting levels/frequency
- **FINANCIAL (FORM 1921):** Apply commodity specific WBS; Includes O&S; Includes Metadata
- **SOFTWARE (SRDR):** Adds sizing and configuration for ERP applications
- **TECH DATA (FORM 1921-T):** Data Center HW; Infrastructure
- **PROGRAM OFFICE (CARD):** Tabular data; Formatted templates

# Issues

**ISSUE 4: WHO MANAGES THE REQUIREMENT, SETS PRIORITIES AND ENSURES CAPABILITY IS DELIVERED AS REQUIRED AND WHEN REQUIRED TO COMPLETE THE SYSTEM?**

General Approach >>>>

**Define Req'ts  
Roadmap  
Rec/NR**

**Build SW (Code & Unit Test)  
(Release Plan, Velocity, Backlog)**

**Integrate the System  
(HW + SW)**

**Deploy**

**Sustain**

**Gov't\*:  
Define  
Prioritize  
Influence Scrum?**

\*The government owns the requirement.

**Contractor:  
Schedule Backlog  
Execute Sprint  
Manage Velocity  
Meet Gov't needs  
(e.g., how much is enough  
per Increment?)**

**Shared:  
Contractor Support  
Government Lead  
3<sup>rd</sup> Party Hosting/  
Cloud**

---

# BACK-UPS

---

# Agile Terms Table from GAO\*

Term	Definition	Also called
Project Roadmap	High level view of the features the project will set out to accomplish along with the expected business value	Project Vision
Release Plan	Schedule for developing working software that identifies the expected number of sprints and features that will be included in a release	
Epics	High level capabilities	High level Requirements
Features	Next level below an epic which represents items of specific business value. Some features may need several stories to be complete.	Capabilities
User Story	Small chunk of software that identifies business value and success criteria that can be completed within a sprint timebox. A user story defines the work to be done to satisfy a feature.	
Story points	Assessed value of effort for an epic, feature, or user story based on team consensus	Complexity Points
Sprints	short-term, timeboxed effort for delivering an agreed upon number of story points	Iterations, increments
Product Backlog	List of prioritized user stories identified as Must Haves, Should Haves, Could Haves and Nice to Haves	Requirements backlog, feature list
Burn down Chart	Burn down charts represent completed user stories and reflect the rate of progress over time. Can be compared to estimated number of stories to be completed during each sprint for variance analysis.	Burn up chart
Retrospective	Final review of what was accomplished during a sprint and documentation of lessons learned (Agile team and customers/stakeholders attend)	
Velocity	The rate of progress accomplished by the team during a sprint (measures number of story points delivered per sprint to better estimate future work). Velocity reflects a team's cadence and will vary among teams.	Cadence

\*Ref: GAO Scheduling Assessment Guide (DRAFT), May 2012; Agile Appendix (Sept 2015); 10 Best Scheduling Practices.

# Additional Definitions

---

- **Velocity is a “team” measurement – not the individual**
- **Iteration Duration / Completed Total SP = Velocity**
- **Iterations needed = Total SP / Velocity**
- **Don't change the duration and use the same result**
- **Velocity Measure provides a way to translate a Size into a duration**
  - **Every estimate starts with a Size estimate (Lines of Code, Function Points, Use Case Points, Ideal Days, Story Points, Hot Dogs in a bucket!)**
- **Size / Velocity = Duration**
- **Every estimation process requires a relationship between a volume measure (Size) and productivity – how much size can be done over time**
- **Velocity can be used as a TEAM productivity measure.**

