



**PARCA
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“Informing BCWP with TPMs and Risk” Integrated Program Management Webinar

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PARCA Deputy Director for EVM**

July 16, 2015



Agenda

- ▶ OSD PARCA

- ▶ Integrated Program Management
 - Planning
 - Scheduling

- ▶ Measuring Progress



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OSD PARCA



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PARCA Organization

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**OSD EVM Policy
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**Nunn McCurdy
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**Program
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DAES Selection**

Analysis Team

PARCA was brought into existence via the reforms called for by the Weapon Systems Acquisition Reform Act (WSARA) of 2009

As the central office for major defense authorization performance assessment, root cause analysis, and earned value management (EVM), PARCA advises AT&L on program execution status; and issues policies, procedures, and guidance to the Military Departments and the Defense Agencies to improve program management practices



PARCA EVM Vision

Foster cross functional situational awareness, visibility, and accountability through integrated program management at all levels of the acquisition community



▶ *Guiding Principles*

- Increase the quality and utility of EVM data
- Increase the use of EVM across the acquisition chain
- Improve acquisition professionals' ability to utilize EVM
- Reduce Contractor's administrative burden of inefficient use of EVM
- Foster constructive 2-way communication between DoD and Industry
- EVMS is perceived by all stakeholders to be cost effective



PARCA EVM Organization

PARCA Earned Value Management Division Authorities

Policy and Guidance

Develop, publish, and maintain DOD policy and guidance on EVM

EVM Competency

Serve as DoD EVM Functional Lead to influence EVM competency requirements; Coordinate with Defense Acquisition University (DAU)

EVM Data Requirements

Review and approve EVM data requirements for MDAP programs in coordination with Services and Defense Agencies; Resolve interpretive differences in EVM policy, practice, and requirements

EVM Central Repository

Be responsible for the Earned Value Mgt Central Repository (CR) and maintain CR data alignment with the Acquisition Visibility framework; Report EVM data compliance, integrity, and quality to AT&L

Communications and Outreach

Maintain communications with Government and Industry on EVM policy



PARCA is responsible and accountable for EVM performance, oversight, and governance across the Department



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INTEGRATED PROGRAM MANAGEMENT



Integrated Program Management

- ▶ Must begin with a disciplined planning process that defines the work, organization, resources, time phased plan, and set of technical objectives
- ▶ Uses all stakeholder views in evaluating status and adjusting the plan
- ▶ Allows for the natural discovery of complex problems to be incrementally detail planned and executed
- ▶ Offers measures that serve as leading indicators, current status, and projected status





Getting the WBS “Right” is Paramount

Technical:

- TPMs
- Specifications
- Design docs
- Performance charts

Earned Value:

Cost / Schedule Status



MIL-STD-881C
APPENDIX A

A.3 WORK BREAKDOWN STRUCTURE LEVELS

WBS #	Level 1 Aircraft System	Level 2	Level 3	Level 4
1.0		Air Vehicle		
1.1			Airframe	
1.1.1				Airframe Integration, Assembly, Test and Checkout
1.1.1.1				Fuselage
1.1.1.2				Wing
1.1.1.3				Empennage
1.1.1.4				Components 1..n (Specify)
1.1.1.5				System Integration, Assembly, Test, and Checkout
1.1.1.6				Subsystem
1.1.2				System
1.1.3				System
1.1.3.1				System
1.1.3.2				System
1.1.3.3				System
1.1.3.4				System
1.1.3.5				System
1.1.3.6				System
1.1.3.7				Control Subsystem
1.1.3.8				Fuel Subsystem
1.1.3.9				Landing Gear
1.1.3.10				Rotor Group
1.1.3.11				Drive Group
1.1.3.12				Vehicle Subsystem Software
1.1.3.13				Other Subsystems 1..n (Specify)
1.1.4				Avionics
1.1.4.1				Avionics Integration, Assembly, Test, and Checkout
1.1.4.2				Communication/Identification
1.1.4.3				Navigation/Guidance
1.1.4.4				Mission Computer/Processing
1.1.4.5				Fire Control
1.1.4.6				Data Display and Controls
1.1.4.7				Survivability
1.1.4.8				Reconnaissance
1.1.4.9				Automatic Flight Control
1.1.4.10				Health Monitoring System
1.1.4.11				Stores Management
1.1.4.12				Avionics Software Release 1...n

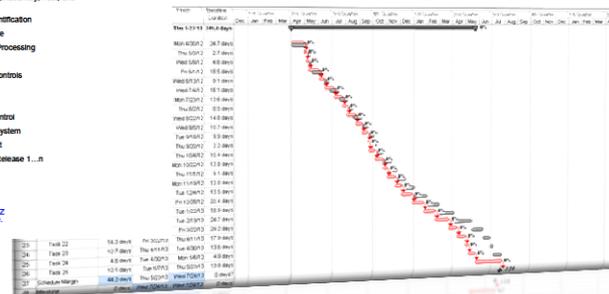
WBS

Risk & Risk Assessment:

- Technical and Program Risk
- Reducible and Irreducible

Schedule:

IMP / IMS



The WBS facilitates communication across the program



Planning

- ▶ Understanding the work scope
- ▶ Developing a budget for the work scope
- ▶ Assigning resources to the work scope



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WBS, Dictionary, Budget, CAM, TPM, Risk

Level									WBS Dictionary	Budget(\$M)	CAM	Weight(lb)	Size	Power	Resolution
WBS Level 1	Aircraft System									200	Director Joe	25000			
WBS Level 2	Air Vehicle									200		25000			
WBS Level 3	Airframe									25	Fred	9000			
WBS Level 3	Propulsion									30	Sam	7000			
WBS Level 3	Vehicle Subsystems									15	Sally	3500			
WBS Level 3	Avionics								Design, Build, and Test Avionics Suite to perform all the cool display and coorelation functions of this aircraft.	30			2500		
WBS Level 4	Avionics Integration, Assembly, Test, and Checkout								Integrate and formal test the avionics subsystem, test plans, procedures, reprot, etc	3	Judy		0		
WBS Level 4	Communications/Identification								Design Build and test comms	2	George		100		
WBS Level 4	Navigation/Guidance								Design Build and test Nav	2	Elroy		100		
WBS Level 4	Mission Computer/Processing								Design Build and test mission computer	4	Astro		200		
WBS Level 4	Fire Control								Design Build and test Fire Control	2	Beasley		300		
WBS Level 4	Data Disply and Controls								Design Build and test Controls and Displays	2	Hans		300		
WBS Level 4	Survivability								Design Build and test Suvivability subsystem	2	R2D2		400		
WBS Level 4	Reconnaissance								Design Build and test Recon Sensors	2	Leah		400		
WBS Level 4	Automatic Flight Controls								Design Build and test Flight Controls	2	Heather		150		
WBS Level 4	Health Monitoring System								Design Build and test Health system	2	Pete		200		
WBS Level 4	Stores Management								Design Build and test SMS	2	Christine		350		
WBS Level 4	Avionics Software Release 1...n								Design Build and test Avionics Software	5	Superman		0		
WBS Level 3	Armament/Weapons Deliver											1000			
WBS Level 3	Auxillary Equipment											1000			
WBS Level 3	Furnishings and Equipment											1000			
WBS Level 3															
WBS Level 3															
WBS Level 2	Sys														
WBS Level 2	Pro														

Comprehensive decomposition of work into manageable “chunk” where each “chunk” can be described in the each domains context



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Agile WBS Concept

WBS#	Level	WBS Dictionary	Budget(\$M)	CAM	Weight (lbs)	Size	Power	Accuracy
1.1.4	WBS Level 3	Avionics Design, Build, and Test Avionics Suite to perform all the cool display and coorelation functions of this aircraft.	30		2500			
1.1.4.1	WBS Level 4	Avionics Integration, Assembly, Test, and Checkout		3 Judy	0			
1.1.4.2	WBS Level 4	Communications/Identification		2 George	100			
1.1.4.3	WBS Level 4	Navigation/Guidance		2 Elroy	100			
1.1.4.3.1	WBS Level 5	Prime Mission Product(PMP)		2	100			
1.1.4.3.1.1	WBS Level 6	Prime Mission Subsystem		2	100			
1.1.4.3.1.1.1	CA	Navigation System Hardware		2	100			
1.1.4.3.1.1.1.1	WP	Analysis		2				
1.1.4.3.1.1.1.2	WP			2				
1.1.4.3.1.1.1.3	WP	Hardware Test		2				
1.1.4.3.1.1.1.4	WP	Hardware Test		2				
1.1.4.3.1.1.2	CA	PMP Subsystem Software		2	0			Identify current location
1.1.4.3.1.1.2.1	WP	EPIC/Feature Set 1		2				Establish waypoints
1.1.4.3.1.1.2.2	WP	EPIC/Feature Set 2		2				Support
1.1.4.3.1.1.2.3	WP	EPIC/Feature Set 3						
1.1.4.3.1.1.2.4	WP	EPIC/Feature Set 4						
1.1.4.3.1.1.3	CA	Subsystem Integration, Asses						
1.1.4.3.1.2	WBS Level 6	PMP Software Release						

Traditional WBS

Technical criteria for success flows top down

Epic Name	Feature Name	Story Name	Acceptance Criteria	Story Pts	Cost (\$M)	Objective Technical Measure
		Identify current location	Deliver Epic feature set 1	2		Identify current location to within 1 meter
	Feature 1		Demonstrate Feature 1 Capability	22		Definition of feature 1 test success criteria
		Story 1.1	Story 1 capability demonstrated	3		Definition of feature 2 test success criteria
		Story 1.2	Story 2 capability demonstrated	8		Definition of feature 3 test success criteria
				2		Definition of feature 4 test success criteria
				1		Definition of feature 5 test success criteria
				3		Definition of feature 6 test success criteria
		Story 1.6	Story 6 capability demonstrated	5		Definition of feature 7 test success criteria
	Feature 2		Demo Feature 2	35	0.2	
	Feature 3		Demo Feature 3	28	0.1	
	Feature 4		Demo Feature 4	45	0.3	
	Feature 5		Demo Feature 5	34	0.2	
	Feature 6		Demo Feature 6	21	0.1	
	Feature 7		Demo Feature 7	18	0.1	
	Establish waypoints		Deliver Epic feature set 2		2	Able to establish and store over 1000 waypoints
	Support automatic route nav		Deliver Epic feature set 3		2	Able to provide flight controls position data to hold A/C within 50 ft of course
	Support in-flight route updat		Deliver Epic feature set 4		2	Able to receive and update flight route within 30ms

Product Backlog

Mil-Std-881C allows for Agile work scope definition. In cases where SW is the only product the backlog is the WBS



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SCHEDULING



Getting the Roadmap “Right” is Paramount

- ▶ Event-based planning allows for Tier 0-1 strategic planning
 - Sets boundaries for critical path
 - Establishes target delivery objectives
 - Facilitates incremental plan maturation (Rolling Wave Planning)

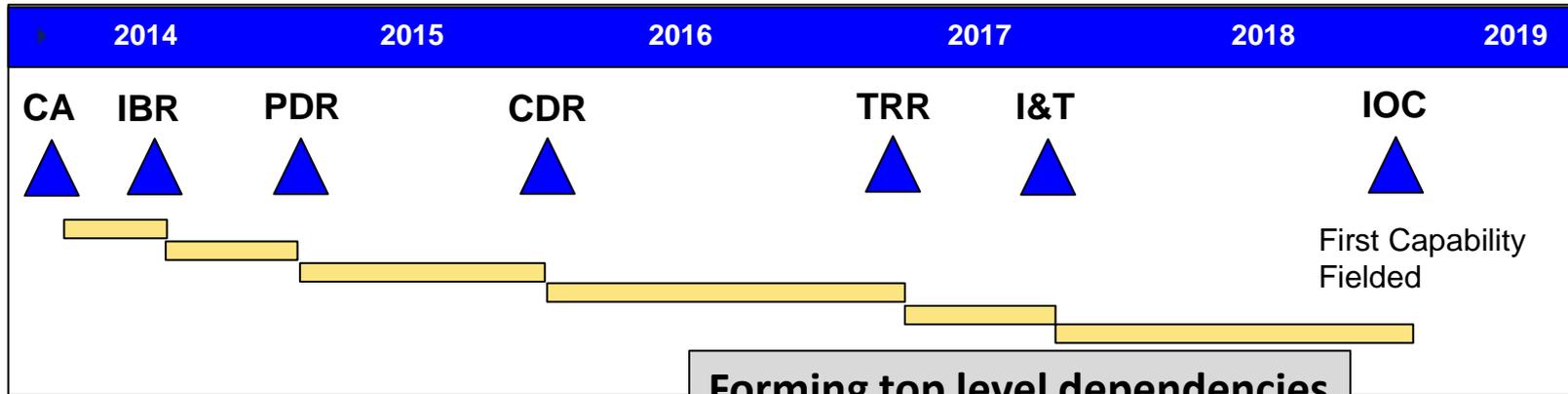
- ▶ Provides structure for near-term detailed planning

- ▶ Allows for strategic direction assessment and course correction

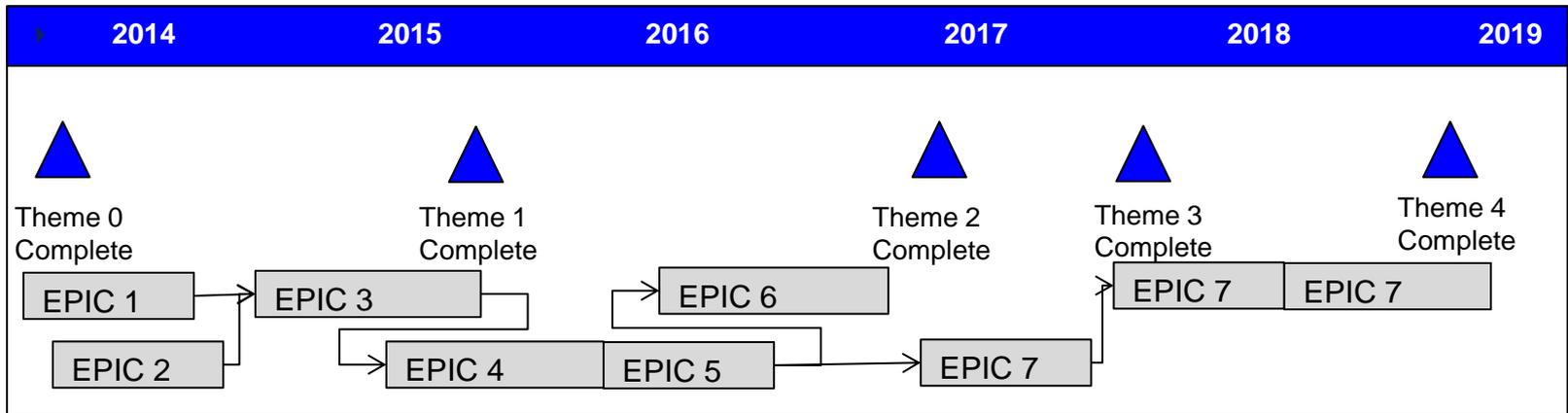


Event Based Planning

Traditional – Tier 0 Schedule



Agile - Roadmap





Integrated Master Plan (IMP) Concepts

Traditional

Activity Number	Activities
A	IMP Event
A01	IMP Accomplishment
A01a	IMP Criteria
A01a01 - n	IMS Task
A	PDR Completed
A01	Requirements Analysis Completed
A01a	Avionics Requirements Analysis Completed
A01a01	Perform Avionics Requirements Analysis
A01a02	Develop Avionics Draft Specification
A01a03	Coordinate Avionics Draft Specification for Review
A01a04	Publish Avionics Specification

Agile

Activity Number	Activities
A	IMP Event
A01	IMP Accomplishment
A01a	IMP Criteria
A01a01-n	IMS Task
A	Theme 1 Complete
A01	EPIC 1 Complete
A01a	Feature 1 Complete
A01a01-n	Agile Backlog Stories not in IMS
	Feature 2-m Complete
A01b	EPIC 2 Complete

Figure 2. IMP and IMS Numbering System



Event-Based Planning (Road Mapping)

DoD IMP/IMS Preparation and Use Guide
V0.9 October 21, 2009

1.1.4.3	WBS Level 4	Navigation/Guidance
1.1.4.3.1	WBS Level 5	Prime Mission Product(PMP)
1.1.4	5	Prime Mission Subsystem
1.1.4		PMP Subsystem Hardware
1.1.4		PMP Subsystem Software
1.1.4		Subsystem Integration, Assembly, Test, and Checkout
1.1.4.3.1.2	WBS Level 6	PMP Software Release 1...n
1.1.4.3.1.2.1	CA	Software Product Engineering
1.1.4.3.1.2.2	CA	Com...
1.1.4.3.1.2.2.1	WP	CSC
1.1.4.3.1.2.2.2	WP	CSC
1.1.4.3.1.2.2.3	WP	CSC
1.1.4.3.1.2.2.4	WP	CSC
1.1.4.3.1.2.3	CA	Com...
1.1.4.3.1.2.3	CA	Subsy
1.1.4.3.1.3	WBS Level 6	PMP In
1.1.4.4	WBS Level 4	Mission C

WBS

Activity #	Event Accomplishment Criteria	IMP	WBS REF
E	Event E - Initial Production Complete (IPC)		
ED1	Version 1 Kit Production and Delivery Completed		-
ED1a	Version 1 Subassemblies Completed		1.1.2.2, 1.2.2
ED1b	Version 1 Assembly/Integration/Test Completed		1.1.2.2
ED1c	Version 1 Packaging and Delivery Completed		1.1.2.2
ED2	Version 1a Kit Production and Delivery Completed		-
	Subassemblies Completed		1.1.2.4, 1.2.2
	Assembly/Integration/Test		1.1.2.4
	ing and Delivery		1.1.2.4

- The IMP is expanded to incorporate all detailed tasks required to accomplish the individual IMP criteria
- The tasks are then applied against a time line to develop the IMS
- Tool to manage risk

As the plan matures, the technical objectives are flowed from the WBS through the IMP into the IMS

Activity#	Task Name	IMS			
		Q1	Q2	Q3	Q4
ED1	Version 1 Kit Production and Delivery complete				
ED1a	Version 1 Subassemblies Completed				
ED1a01-1.1.2	Generate bill of material				
ED1a02-1.1.2	Generate operation/routing sheets				
ED1a03-1.2.2	Order components/subassemblies and raw material				
ED1a04-1.1.2	Receive raw material				
ED1a05-1.1.2	Fabricate in-house components/subassemblies				
ED1a06-1.1.2	Receive purchased components/subassemblies				

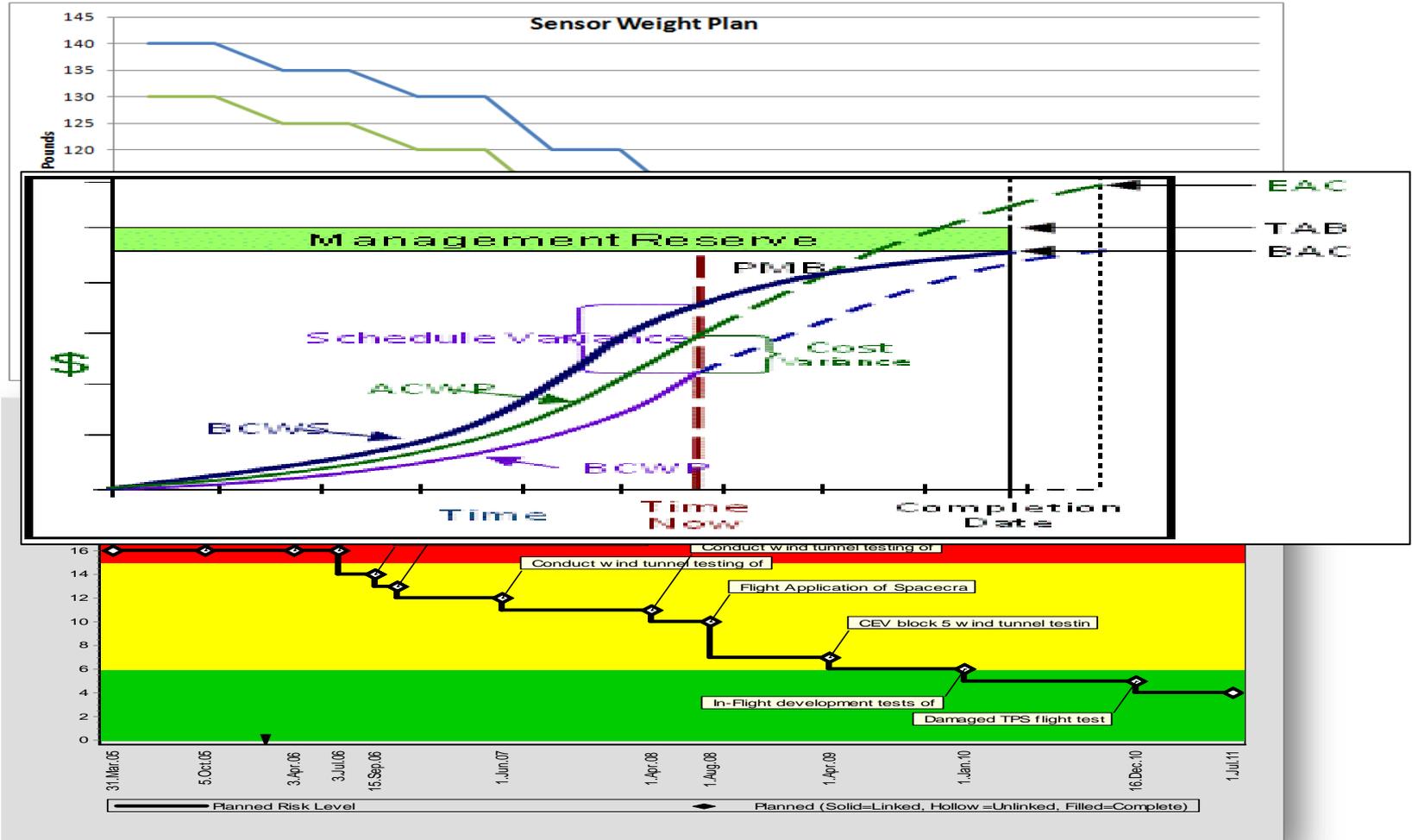


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MEASURING PROGRESS



Time Phased TPM, Risk, & Budget





PARCA Thoughts: Determine Physical % Complete using both Task Completion and Technical Status

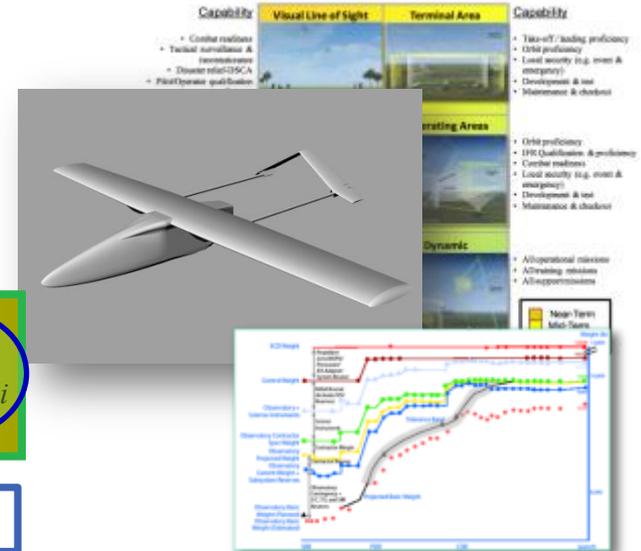
Measuring progress of what people do



$$\sum_{i=1}^N \dot{a} BCWP_i = \sum_{i=1}^N \dot{a} BCWS_i \cdot P\%C_i$$

Physical Percent Complete (P%C)

Measuring progress of the Result of what people do



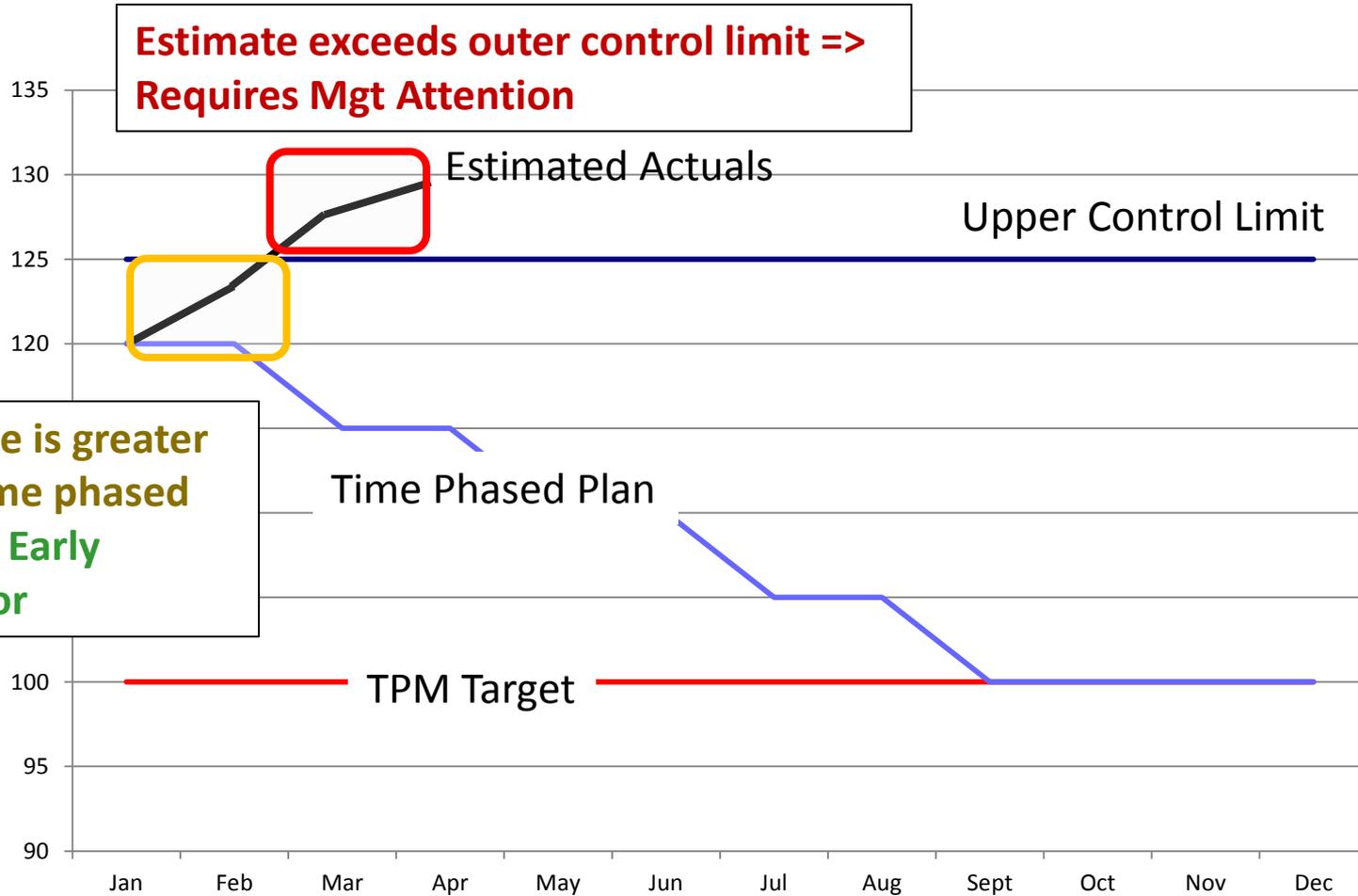
- ▶ Progress of a set of tasks
 - Drawings Completed
 - Lines of Code Written
 - Work Products Produced
 - Reviews Completed

- ▶ Progress of the technical status
 - Critical TPM Achievement
 - System Capabilities Met
 - Quality of Work Products
 - System Under Review Acceptable

Mission progress is measured by *effectiveness* of outcomes to the end user



TPM Estimated Actuals Added Over Time to Exercise Study Scenarios



Estimate exceeds outer control limit =>
Requires Mgt Attention

Estimate is greater than time phased plan => Early Indicator

SFR

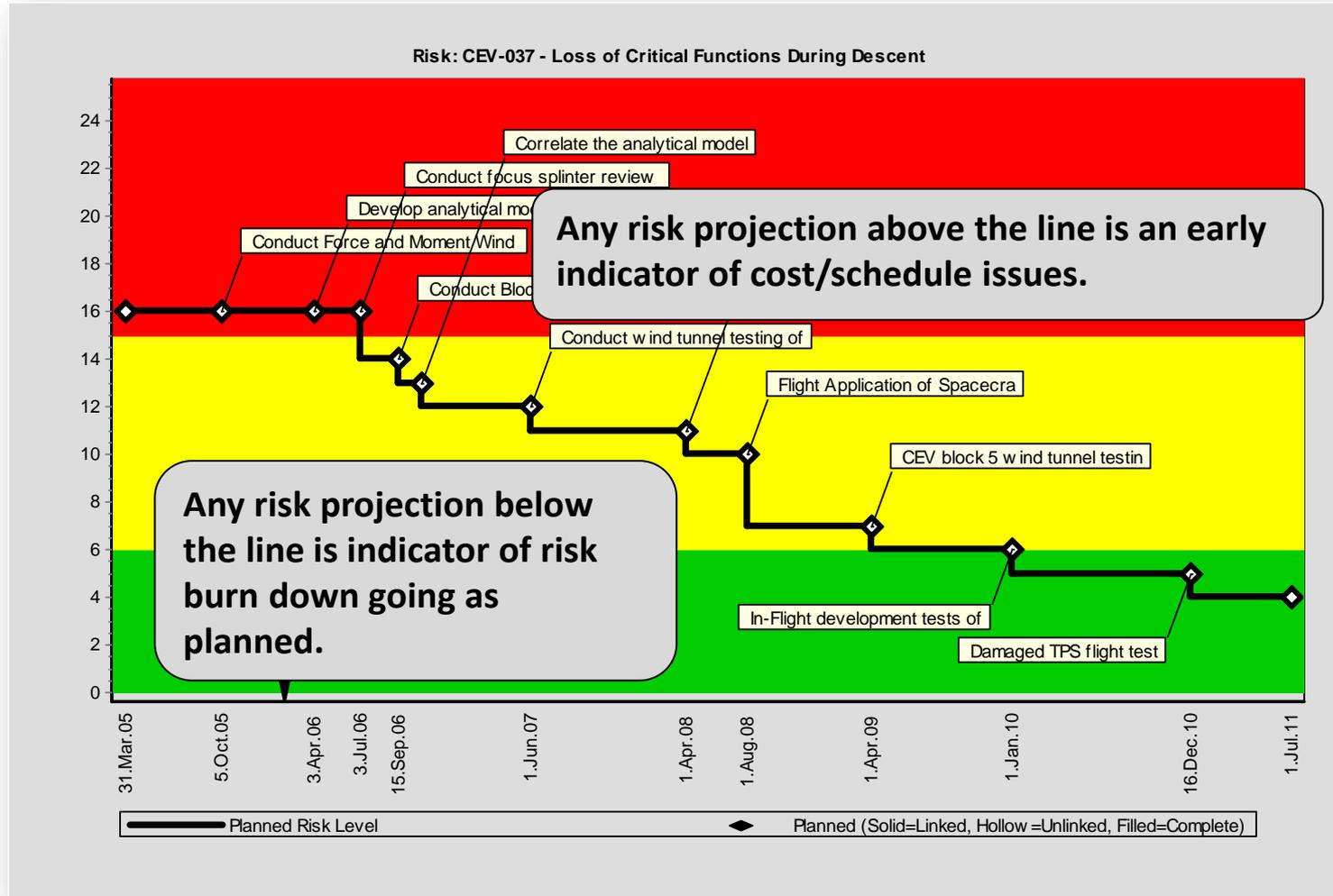
— Upper Control Limit — Requirement Weight — Planned Weight — Actual Estimate

PDR



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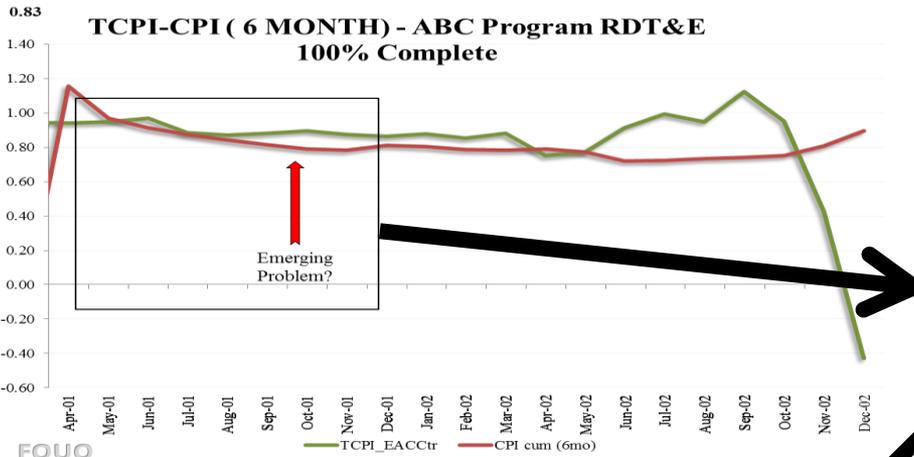
Time Phased Reducible Risks Impact Future Performance





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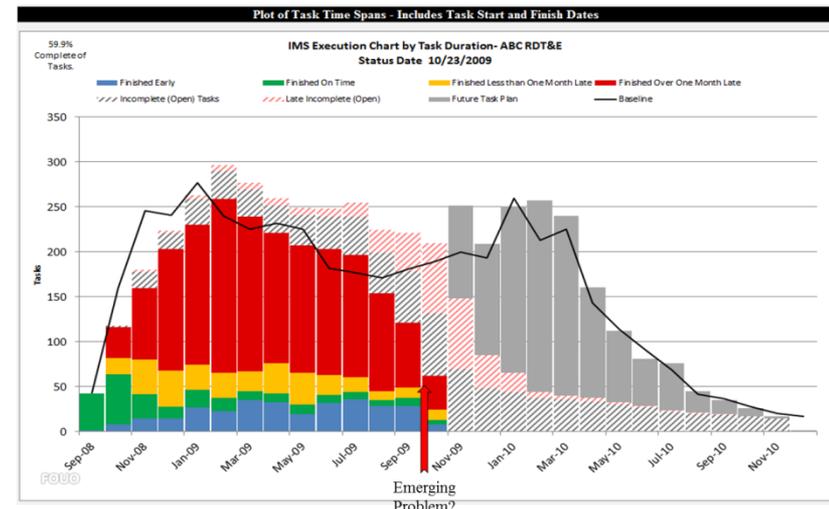
Integrated Cost and Schedule Analysis



TCPI Scoreboard

Program	ABC			*No WBS level Performance Data				OCT-01
Contract	RDT&E			6 month CPI	TCPI BAC	TCPI EAC	Δ	Risk
Element Name	Element ID	Reporting Level	6 month CPI	TCPI BAC	TCPI EAC	Δ	Risk	
ABC Level 1	0	0	0.81	0.43	0.90	-0.09		
Seeker Assembly	1.1.6.1.1	4	1.08	0.97	1.02	0.06		
Guidance Electronics	1.1.6.1.2	4	0.91	11.07	1.14	-0.22	High	
Health Monitoring Unit (HMU)	1.1.6.1.3	4	1.56	0.90	1.06	0.49	*	
Cooling Gas Bottle	1.1.6.1.4	4	0.98	0.94	1.02	-0.05		
Guidance Section Integ, Assy, Test & Che	1.1.6.1.5	4	0.99	0.85	1.02	-0.03		
Navigation/Guidance/Control Software	1.1.6.4.1	4	2.27	0.89	1.69	0.58		
Sensor Software	1.1.6.4.2	4	1.03	1.02	1.54	-0.51	High	
Mission Software	1.1.6.4.3	4	0.63	0.00				
Software Integration, Assy, Test & Check	1.1.6.4.4	4	0.52	-0.32	50.48	-49.96	High	
Rotary Wing Launcher Hardware	1.2.6.1.1	4	0.97	1.07	1.01	-0.04		
Rotary Wing Launcher Software	1.2.6.1.2	4	0.64	1.59	1.01	-0.37	High	
Fixed Wing Launcher Hardware	1.2.6.2.1	4	0.90	1.16	1.02	-0.12	High	
Fixed Wing Launcher Software	1.2.6.2.2	4	1.00	1.00	1.00	0.00		

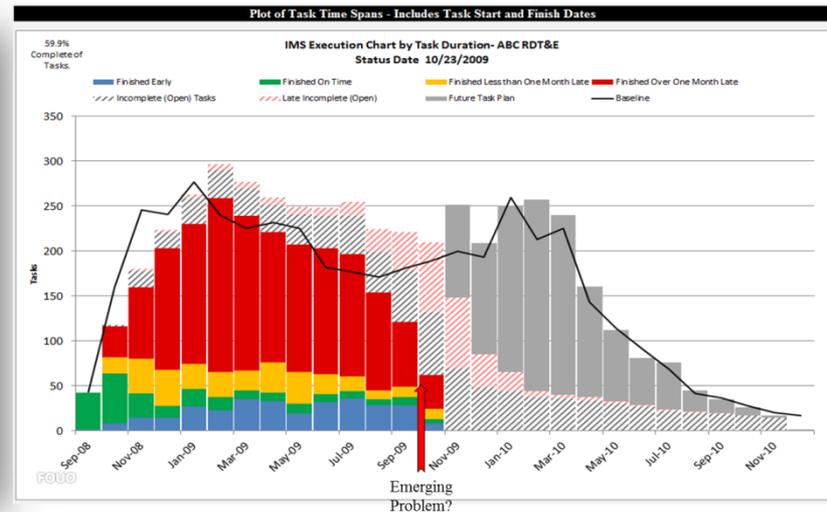
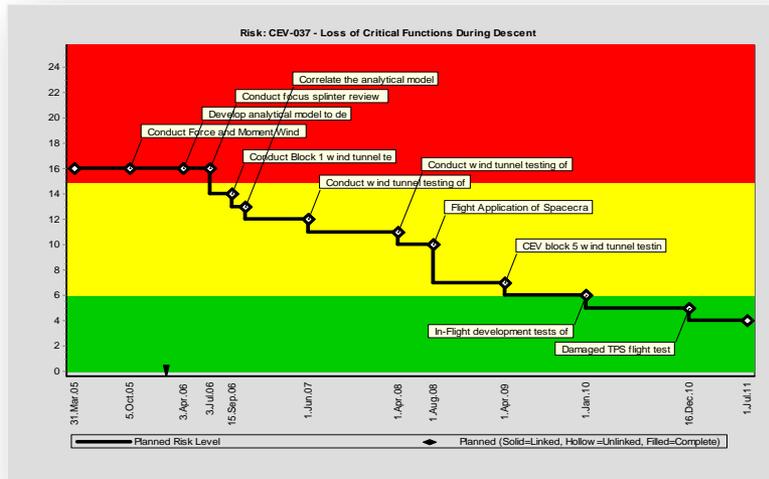
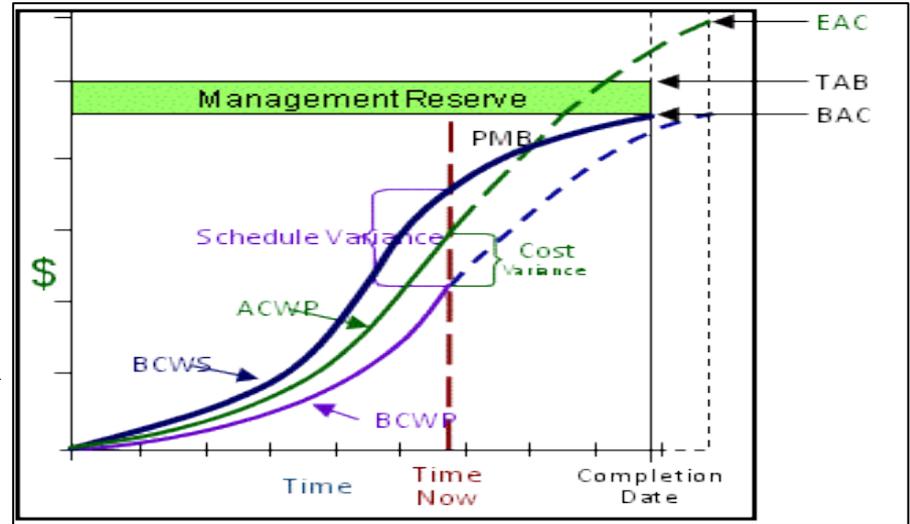
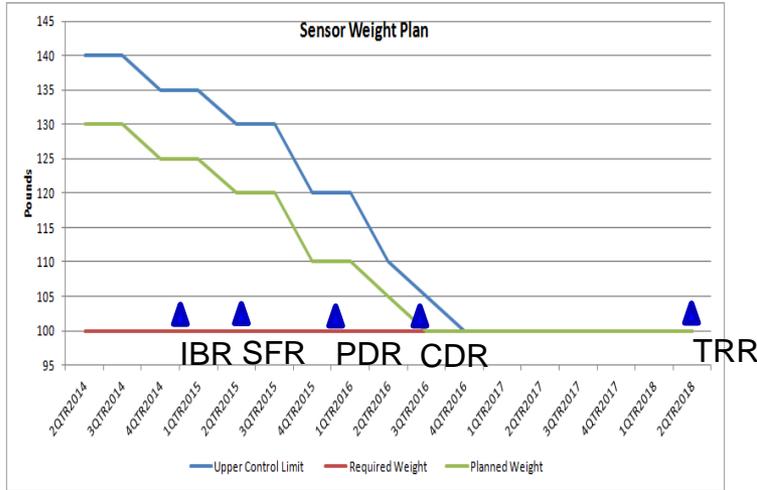
% CWBS	Task Name	Finish	Float	Variance
100%	Receive GCU Reuse	21d	0d	
0%	Deliver GCU Card for	4d	41d	
0%	Deliver GCU Card for	0d	52d	
0%	Deliver GCU Card for	0d	30d	
0%	Deliver GCU Card for	0d	92d	
0%	Deliver GCU Card for	0d	43d	
0%	Deliver GCU Card for	0d	36d	
100%	Receive Missile GCU	14d	0d	
100%	Receive EDT GCU Rq	39d	0d	
100%	Deliver EDT EU TDP	15d	0d	
100%	Release CTMS EU TI	0d	0d	
100%	Receive Missile GCU	25d	0d	
100%	Receive Missile GCU	26d	0d	
100%	Receive Tactical EU	15d	0d	
0%	Guidance Electronics	12d	0d	
0%	Mission Controller/Sig	2d	0d	
0%	Guidance Electronics	2d	0d	
0%	SP Development com	5d	0d	
100%	SP Development com	0d	0d	
100%	SP Development com	4d	0d	
100%	SP Development com	10d	0d	
100%	SP Development com	33d	0d	
0%	Receive GNC STS for	11d	0d	
0%	Receive Telemetry fro	10d	156d	
0%	Receive Range Data f	10d	156d	
0%	Receive Telemetry fro	4d	23d	
0%	Receive Range Data f	4d	23d	
0%	Boeing Current Launch	0d	40d	
0%	Boeing F/W Launcher	51d	250d	
0%	Launcher Pilot Manuf.	25d	113d	
100%	Boeing Launcher Bill	18d	0d	
0%	Boeing Launcher Bill	0d	270d	
0%	Boeing Launcher Proi	31d	239d	
0%	Supplier Manufacturing	59d	211d	
0%	F/W Launcher PDR C	26d	49d	
0%	Launcher FW Non Fun	0d	242d	





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Integrated "Dashboard" Concept





Summary

- ▶ Accurate technical status reporting in starts with the development of the plan.
- ▶ All disciplines of a program relate their respective status to the WBS and most have a time phased projection for success. **LEVERAGE THAT FACT**
- ▶ Integrated analysis is the evaluation of each domains' status against their respective time phased plans.
- ▶ Proactive data driven analytics foster successful program execution.



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Thoughts?

Questions?