



The AFIT of Today is the Air Force of Tomorrow.

Rapid / Expedited Systems Engineering

**Presented To:
3rd Annual SERC Research Review**

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3rd Annual SERC Research Conf. 5-6 Oct 2011



Successful SE Layered Integrated Framework



The AFIT of Today is the Air Force of Tomorrow.

Oversight & Control Activities
(Governance: Policy, Councils, Oversight Boards, etc)

Collaborative Environments & Hierarchical Organizations
(Where SE's Work)

Standard Systems Engineering Processes
(Tailored to Meet Organizational Needs)

Common Methods, Models & Tools
(Future Will Demand Greater Interoperability)

Common Language
(Obtained Through; Education, Training & Experience)

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Overarching Conceptual Construct



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Systems



Design Environments



Developed w/
in
Environments



Enabling
Capabilities

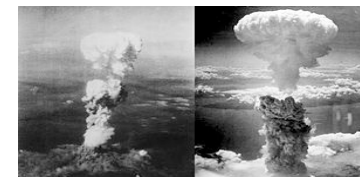
Capabilities



Deliver an
Effect



Effects



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Overarching Conceptual Construct Where SE's Primarily Reside



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Systems



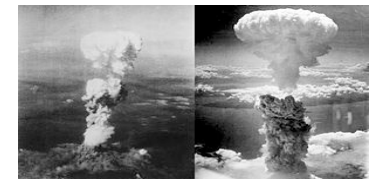
Design Environments



Capabilities



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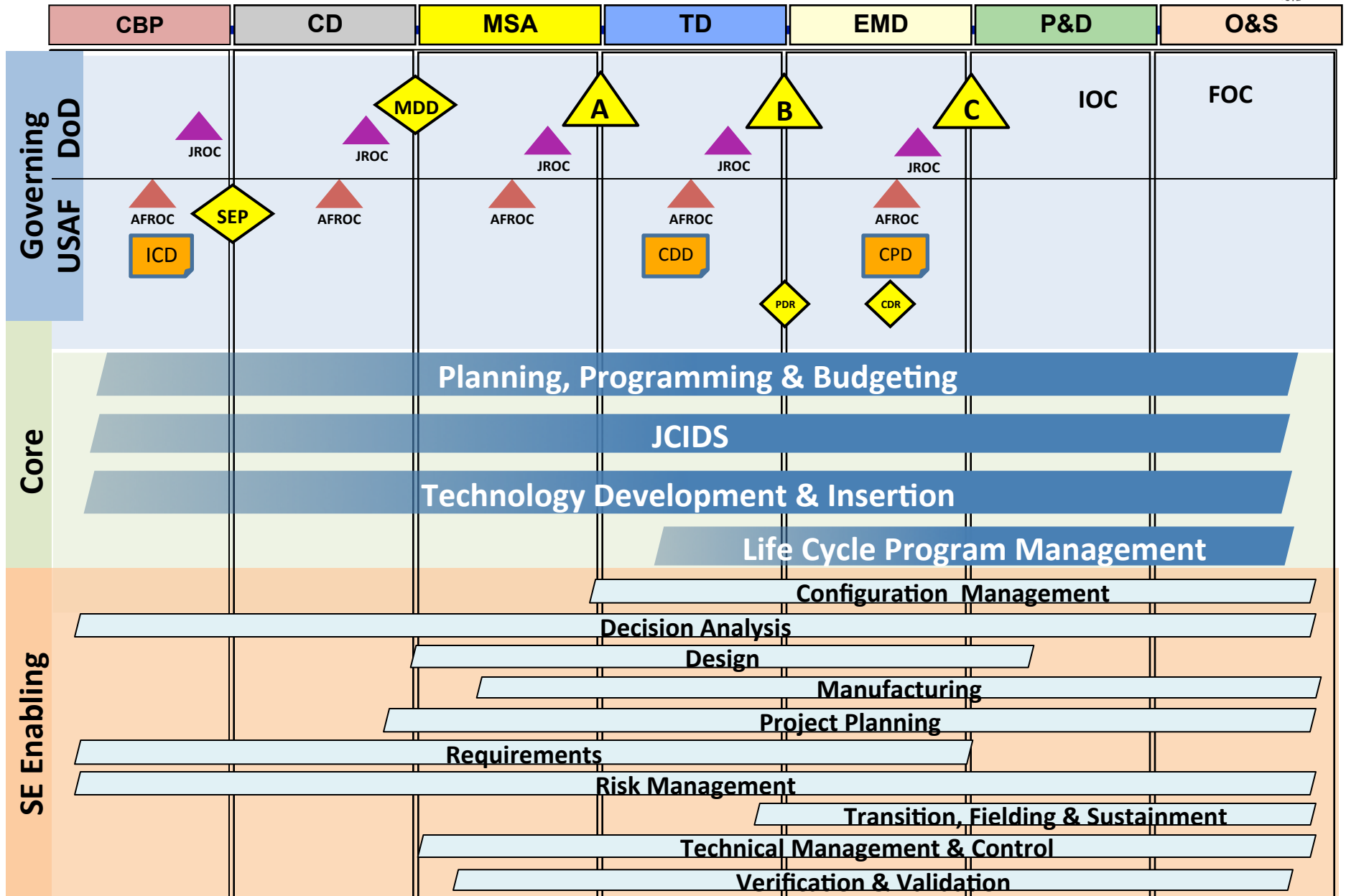
Enabling
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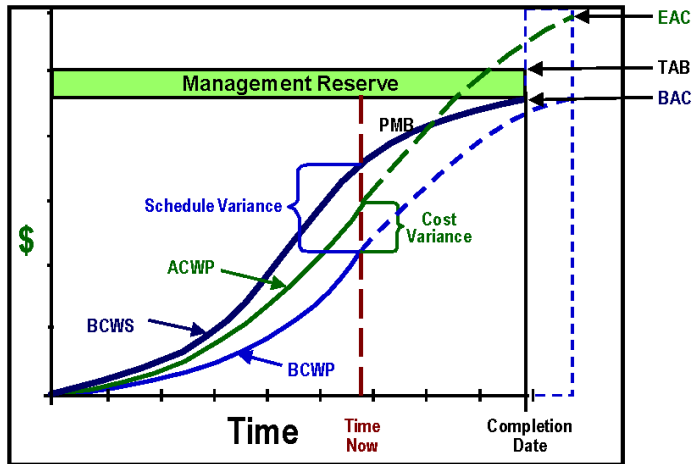
Systems Engineering Processes In Context





EARNED VALUE MANAGEMENT

'GOLD CARD'



VARIANCES Favorable is Positive, Unfavorable is Negative

Cost Variance $CV = BCWP - ACWP$ $CV\% = (CV / BCWP) \times 100$

Schedule Variance $SV = BCWP - BCWS$ $SV\% = (SV / BCWS) \times 100$

Variance at Completion $VAC = BAC - EAC$

OVERALL STATUS

% Schedule = $(BCWS_{CUM} / BAC) \times 100$

% Complete = $(BCWP_{CUM} / BAC) \times 100$

% Spent = $(ACWP_{CUM} / BAC) \times 100$

DoD TRIPWIRE METRICS

Cost Efficiency $CPI = BCWP / ACWP$ Favorable is > 1.0 , Unfavorable is < 1.0

Schedule Efficiency $SPI = BCWP / BCWS$ Favorable is > 1.0 , Unfavorable is < 1.0

BASELINE EXECUTION INDEX (BEI) = A Schedule Metric

$BEI = \text{Tasks with Actual Finish Date} / (\# \text{ of Baseline Tasks Scheduled to Finish Prior to Status Date} + \text{Tasks Missing Baseline Start or Finish Date})$

CRITICAL PATH LENGTH INDEX (CPLI) = A Schedule Metric

$CPLI = (CP \text{ Length}_{(Time Now To Contract End)} + \text{Total Float}_{(To Contract End Baseline Finish)}) / CP \text{ Length}$

$\text{Hit / Miss} = \text{Month's Tasks Completed ON or AHEAD} / \text{Month's Tasks Scheduled to Complete}$

ESTIMATE @ COMPLETION (EAC) = Actuals to Date + [(Remaining Work) / (Performance Factor)]

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

$= BAC / CPI_{CUM}$

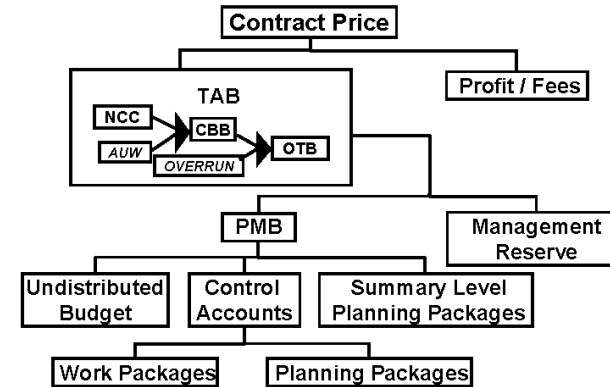
$EAC_{Composite} = ACWP_{CUM} + [(BAC - BCWP_{CUM}) / (CPI_{CUM} * SPI_{CUM})]$

§ TO COMPLETE PERFORMANCE INDEX (TCPI)

$TCPI_{EAC} = \text{Work Remaining} / \text{Cost Remaining} = (BAC - BCWP_{CUM}) / (EAC - ACWP_{CUM})$

To Determine a Contract Level TCPI or EAC; You May Replace BAC with TAB

§ To Determine the TCPI BAC or LRE Substitute BAC or LRE for EAC



ACRONYMS

ACWP Actual Cost of Work Performed	Cost actually incurred in accomplishing work performed	= ACTUAL COST
AUW Authorized Unpriced Work	Work contractually approved, but not yet negotiated / definitized	
BAC Budget At Completion	Total budget for total contract thru any given level	
BCWP Budgeted Cost for Work Performed	Value of completed work in terms of the work's assigned budget	= EARNED VALUE
BCWS Budgeted Cost for Work Scheduled	Time-phased Budget Plan for work currently scheduled	= PLANNED VALUE
CA Control Account	Lowest CWBS element assigned to a single focal point to plan & control scope / schedule / budget	
CBB Contract Budget Base	Sum of NCC & AUW	
EAC Estimate At Completion	Estimate of total Cost for total contract thru any given level may be generated by Ktr, PMO, DCMA, etc. = $EAC_{Ktr / PMO / DCMA}$	
LRE Latest Revised Estimate	Ktr's EAC or EAC_{Ktr}	
MR Management Reserve	Budget withheld by Ktr PM for unknowns / risk management	
NCC Negotiated Contract Cost	Contract Price Minus profit or fee(s)	
OTB Over Target Baseline	Sum of CBB & recognized overrun	
PAC Price At Completion	NCC Plus Profit or Fee(s)	
PMB Performance Measurement Baseline	Contract time-phased budget plan	
PP Planning Package	Far-term CA activities not yet defined into WPs	
SLPP Summary Level Planning Package	Far-term activities not yet defined into CAs	
TAB Total Allocated Budget	Sum of all budgets for work on contract = NCC, CBB, or OTB	
TCPI To Complete Performance Index	Efficiency needed from 'time now' to achieve a BAC, EAC, or LRE	
UB Undistributed Budget	Broadly defined activities not yet distributed to CAs	
WP Work Package	Near-term, detail-planned activities within a CA	

EVM POLICY: DoDI 5000.02, Encl 4, Table 5. EVMS in accordance with ANSI/EIA-748 is required for cost or incentive contracts, subcontracts, intra-government work agreements, & other agreements valued $\geq \$20M$ (Then-Yr \$). EVMS contracts $\geq \$50M$ (TY \$) require that the EVM system be formally validated by the cognizant contracting officer. Additional Guidance in Defense Acquisition Guidebook & Earned Value Management Implementation Guide (EVMIG). EVMS is discouraged on Firm-Fixed Price & Time & Material Contracts; & LOE activities regardless of cost.

EVM CONTRACTING REQUIREMENTS:

- FAR EVM Clauses NOT For DoD**
- 52.234-2 for Solicitation = Pre-Award IBR or - 52.234-3 = Post Award IBR
 - 52.234-4 for Solicitation & Contract
- DoD USE DFAR CLAUSES $\geq \$20M$**
- 252.234-7001 "NOTICE OF EVMS" FOR SOLICITATIONS
 - 252.234-7002 "EVMS" FOR SOLICITATIONS & CONTRACTS
- CONTRACT PERFORMANCE REPORT**
- DI-MGMT-81466A* 5 FORMATS = WBS, ORGANIZATION, BASELINE, STAFFING, EXPLANATION
- INTEGRATED MASTER SCHEDULE**
- DI-MGMT-81650* MANDATORY FOR DoD EVMS CONTRACTS
- INTEGRATED BASELINE REVIEW**
- MANDATORY FOR ALL EVMS CONTRACTS

* Refer to the EVMIG for CPR & IMS tailoring guidance

EVM Home Page = <https://acc.dau.mil/evm>
 eMail Address: EVM.dau@dau.mil
 Revised November 2010



Doing The Same - Differently

SAMPLE REPORTING FORMAT

PERIOD ENDING (DATE)

TASK DESCRIPTION	SCHEDULED START DATE	ACTUAL START DATE	SCHEDULED COMPLETE DATE	ACTUAL COMPLETE DATE	BUDGETED AMOUNT (\$)	ACTUAL AMOUNT EXPENDED TO DATE (\$)	ESTIMATED PERCENT COMPLETE	PERCENT EXPENDED TO DATE (BUDGET/ACTUAL) (\$)

Shifting The Curve



What's Needed



The AFIT of Today is the Air Force of Tomorrow.

Collaborative Design and Decision Support:

Tools, methods, processes and environments that allow engineers, warfighters, and other stakeholders to share and discuss choices. This spans human-system interaction, collaboration technology, visualization, virtual environments, and decision support.

Creating The Technical Workplace of Tomorrow

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Breaking It Down



The AFIT of Today is the Air Force of Tomorrow.

- The capability when employed— will serve as the critical integrating component in attainment of systems by bringing together all of the stakeholders (engineers, warfighters, logisticians, etc.) across all of the processes (conception, design, engineering, prototyping, production and field use and adaption).
- At a minimum the environment will link:
 - Engineering models/tools
 - Virtual demonstration space (e.g. war gaming, synthetic environments, virtual environments)
 - Deployed systems (live and physical test environments)
 - Situational factors (e.g. funding constraints, presently available resources, physical environment, threats, political situation, adversarial military and technological capabilities, etc)



Breaking It Down (con' t)



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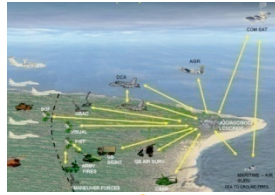
- The purpose of the environment is to:
 - Support a closer to "real-time" Executive Information System (EIS)
 - Enabled by Analysis of Alternatives (AoA) models which together;
 - Drive a Decision Support Systems (DSS)
- The environment must support both development of new systems and stimulate adaption of existing systems
- The goal will be to assist decision makers in decisions regarding:
 - How to best achieve established requirements
 - Examination and setting of requirements based on combined "knee of the curve" determinations
 - "Mission utility breadth assessments"
 - Alternative product and system of systems configurations
 - Divisions of solution between system solution and ConOps

Potential Virtual Collaborative Environment (VCE) OV-1

Systems with Resilient Qualities

Derived as a result of improved decision processes, understanding and sharing of critical engineering and acquisition information

RDT&E Feedback



Transfer



Transfer



Transfer

Warfighter Feedback

Decision Makers



Program Managers



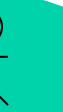
Engineers



Analysts



Users



Managed Information Sharing Environment:

Collaborative Capabilities:
Tools, Services, Social & Virtual Spaces

MBSE

Model Based System Engineering

Analysis & SE Processes



Shared Resources & Services

Acquisition Processes

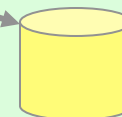
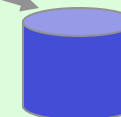
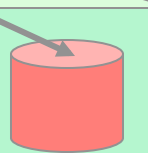
PBE

Platform Based Engineering

Program Information

Authoritative Standardized Data Sources

Government



Industry

Locally managed, accessible, standards compliant information regarding: Requirements, Plans, Architecture, System Engineering, Cost, Performance, Analysis, Logistics



Potential Research Needs



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1. Dissemination:

- Robust, trusted, standardized information exchange policy enforcement services

2. Process - Business:

- Definition of business intelligence services that address enterprise scale large data analytics and visualization of system engineering data

3. Infrastructure - Synthetic Environments for Professional and Social Interactions:

- Social services that inform and integrate the acquisition community



Potential Research Needs (con' t)



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4. People:

- Training & retraining techniques and curriculum to accelerate workforce MBSE skills acquisition and maintenance

5. Security & Information Assurance:

- Policies and supporting tools and methods to ensure cyber security in a relaxed RDT&E CVE IA environment



Potential Research Needs (con' t)



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6. MBSE:

- Automated techniques that can assess modeling patterns and products
- Tools and techniques to reverse engineer and assess legacy systems software to generate modernized less vulnerable code.
- Tools and techniques to simplify and accelerate the transformation of system engineering models into simulated virtual entities for analysis and training



The Challenge



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Create the nations technical workplace of tomorrow by shifting the curve

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