ASN (RDA)
Chief Systems Engineer

Software Process Improvement Initiative

October 21, 2008

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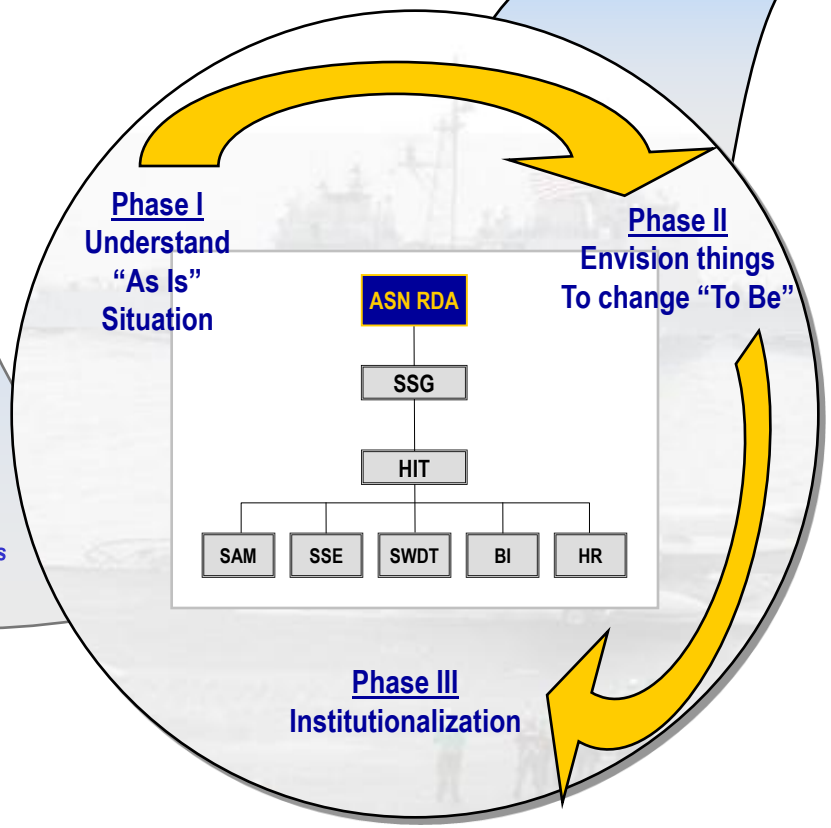
Navy Software Process Improvement Initiative (SPII)

RDA CHIEF SYSTEMS ENGINEER

ENVIRONMENT
(Jan 2006 Offsite)

- Lack Of Government SW Expertise
- New Requirements- No New Cost, ASN/RDA SW Policies
- Requirements
- Testing
- CMM Level Improvements
- SW Certification
- ASN (RDA) Software Policies
- Non-standard Interfaces
- Spiral Development
- COTS
- Resistance To Change
- Immature Costing Models
- EVMS
- External Drivers
- Security
- Processes For Requirements/ Budget Determination
- Non-standard Processes
- Enterprise Licenses
- OA & Standards/ IDDs
- Releasability Concerns
- Industrial Base Concerns



OBJECTIVES

- Increase leadership awareness and accountability
- Better align Naval acquisition with our industry partners
- Develop a skilled acquisition force
- Holistic Systems Engineering Approach focused on key functional areas:
  - Software Acquisition Management
  - Software Engineering Practices
  - Business Implications
  - Software Development Techniques
  - Human Resources

SSG: Senior Steering Group
HIT: Horizontal Integration Team
SAM: Software Acquisition Management
SSE: Software Systems Engineering
SWDT: Software Development Techniques
BI: Business Implications
HR: Human Resources

SPII Charter: 15 May 2006 ASN RDA Memo

The Plan

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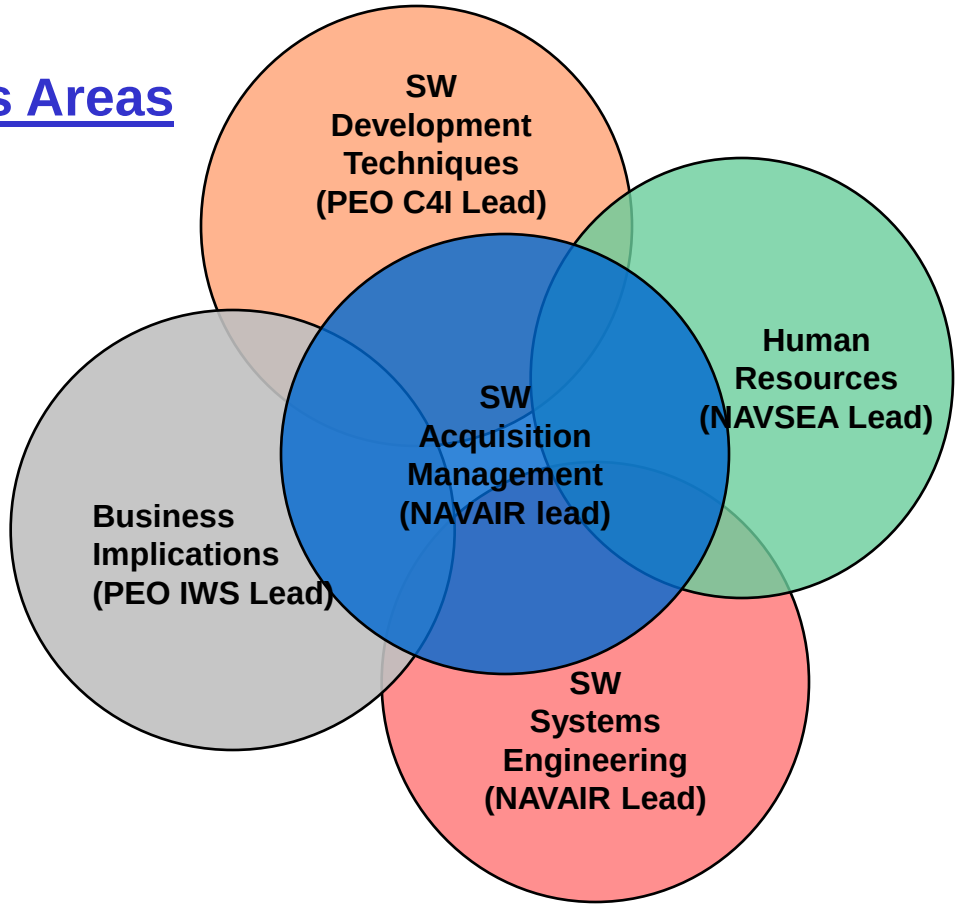
I. As Is:
Understand current situation and review existing policies and reports

II. To Be:
Envision things to come & document changes

III. Institutionalize:
Leverage existing Mechanisms; PEO and SYSCOM responsibilities

5 Focus Areas



Institutionalize

Overarching Policy and Guidebook for Acquisition of SW Intensive Systems

Step-wise Accomplishments

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- As Is" Report signed 17 May 2007
  - Uncovers the current environment for the acquisition of software intensive systems across the Naval Enterprise
  - Findings are consistent with past DSB and NRAC findings
- "Software Development Techniques Phase 1 Report" signed 10 Jul 2007
  - Provides an overview of existing software development techniques and suggestions for evaluating emerging software development techniques
- Program Office Survey Findings Report promulgated July 2007
  - Report verifies the findings of previous studies (e.g., Defense Science Board (DSB)-2000 and Naval Research Advisory Committee (NRAC)-2006) by tracking them directly to current programs of record
- Contract Language Guidance policy memo signed 13 Jul 2007
  - Provides amplifying guidance information on the 17 Nov 2006 Contract Language policy memo

Accomplishments (cont.)

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- Software Metrics White Paper – identified 4 core metrics
- "To Be" Report signed 6 Nov 2007
  - Assists acquisition professionals with a preview of key considerations for major problems having been found to be most troublesome and most commonly documented
- "Role Base Right Fit Training" Report signed 6 Nov 2007
  - Addresses the training issues highlighted by the SAM focus team "As Is" state report, SSE focus team "Program Management Office Survey Findings," DSB, and NRAC findings
- Contract Language policy memo signed 17 Nov 2006
  - Directs standardized contract language for all contracts containing software development, acquisition and life cycle support beginning with RFPs issued after 1 Jan 2007
    - Requires developers to submit Software Development Plan (SDP)

Core Software Metrics

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- The four required core metrics
  - Software Size/Stability
  - Software Cost/Schedule
  - Software Quality
  - Software Organization
- All metrics to be provided during key phases of the system acquisition lifecycle and DoN 2Passes/6Gates

ID	Phase	Milestone-Related Period
I	Concept Development	Pre-Concept Decision (CD)
II	Concept Refinement	Post-CD, Leading to Milestone (MS)-A
III	Technology Development	Post MS-A, Leading to MS-B
IV	System Development and Demonstration (SDD) (System Integration)	Post MS-B, Leading to Design Readiness Review (DRR)
V	SDD (System Demonstration)	Post DRR, Leading to MS-C
VI	Production and Deployment	Post MS-C, Leading to Full Rate Production (FRP) Decision
VII	Operations and Support	Post FRP Decision Review

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Status Reporting Based on Metrics

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- Examples of basic and general usage of metrics:
  - Scope creep and software stability based on software size metrics/trends
  - Software cost and schedule variances, trends, and performance indexes
  - Software defects, trouble reports, and other quality trends
  - Software personnel staffing actuals vs. planned, including training and turnover metrics
- Software 4 Core Metrics infused into Naval Probability of Program Success (PoPS) - Complete

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SPII is Institutionalized!

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- **Software Process Improvement Initiative completed – Sept 2008**
  - **Software Measurement for Naval Software Intensive Systems**
    - 4 core metrics
  - **Overarching Software Process Improvement Policy for Acquisition of Naval Software Intensive Systems**
    - Software Process Management Improvement
    - Contract Language
    - Software Measurement
    - Personnel experience or training
    - Ensure implementation and adherence to processes Software Measurement for Acquisition of Naval Software Intensive Systems
  - **Guidebook for Software Process Improvement for Acquisition of Naval Software Intensive Systems**
    - Provide support to acquisition stakeholder team
    - Organize to capture focus teams products
    - Structure follows acquisition process timeline

"Should-Be" Software Environment

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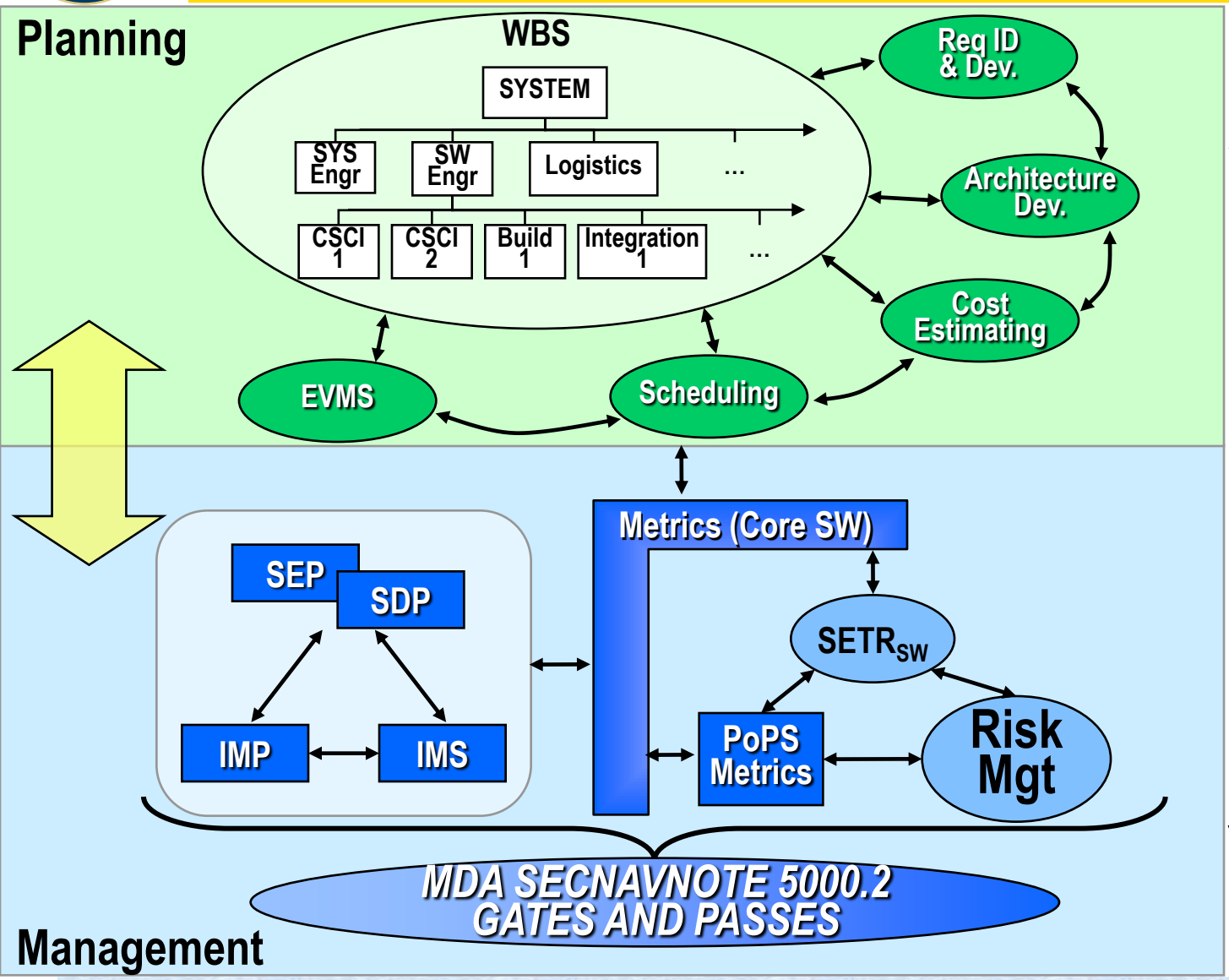

Historical Software Data

- Domain
  - Similar systems
- Key attributes
  - E.g.,
    - Accurate
    - Normalized
    - Etc.

Legend:

Process

Product

SW Infused WBS Supports Effective Software Metrics and Program Management

Institutionalization Next Steps

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- Infuse software into SE Planning, SE Management, and SE Technical Reviews processes
  - Systems Engineering Technical Review (SETR)
  - Systems Assurance
  - Work Breakdown Structure friendly to Software
- Continue working with USD(AT&L), Services, and DAU to meet human resources and training needs
- RDA CHSENG sponsor next updates to:
  - Software development techniques
  - Contract language guidance, when required

Back-up slides

Infusion Into PoPS for Gate Reviews

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- Mapping of software metrics-related timeline phases to Gate Reviews

Lifecycle Phases	SECNAVNOTE 5000
I: Concept Development	Gate 1
II: Concept Refinement	Gates 2 & 3
III: Technology Development	Gates 4 & 5
IV: System Development	Gate 6
V: System Demonstration	Gate 6 (Phase 2)
VI: Production & Deployment	Gate 6 (Phase 3)
VII: Operations & Support	Gate 6 (Phase 4)

  - See Backup slides for overview/description of each Gate Review and policy memos for use of PoPS methodology at Gate Reviews

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SPII Core Measurement and Metrics Update

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Program Office Metrics		Contract Metrics
Cause		Effect
KPP and requirements driven	Software Size	KSLOC and/or function point driven
Cross Functional Match – Effective Communications		
Key Billets/Skills- DAIWIA driven	Organization	Key Billets/Skills – Contract/RFP Identified
Cause		Effect
Government Independent Cost Estimate (ICE); Official Stamp of Program Baseline; Delta in KPP/Requirements	Cost/Schedule	Contract Mods/Out of Scope/Scope Creep based on KPP/req delta
Cause		Effect
KPP and requirements driven T&E Outcomes	Software Quality	Defect Rate/Cost of Rework Based on Quality Based on KPP/Req delta

Details are dependent on SAM organization micro-product, HR skills and capability micro-product; BI contract language review

Motivation for SPII Core Metrics

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Efforts to develop appropriate metrics for performance measurement and continual process improvement.

Software Size → software acquisition planning; requirements development; requirements management

Software Organization → ensure that key program personnel have an appropriate level of experience or training in software acquisition

Software Cost/Schedule

Software Quality

Risk Management → Project Management and Oversight

May 2006 SPII Charter

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"Successful development and acquisition of software is paramount for acquiring Naval Warfighting and business systems. There are many parallel and related efforts underway that address improvement in the acquisition of software products: mandates such as Public Law 107-314 Section 804 and the Clinger-Cohen Act; initiatives such as Software Assurance and Open Architecture (OA); and the development of best practice models such as the Capability Maturity Model Integration (CMMI) for Acquisition. To consolidate these efforts into a focused initiative, I have formed a steering group composed of my senior engineering professionals and led by the ASN (RD&A) Chief Engineer. This group will evaluate existing policies and implement process improvements to enhance our ability to develop and acquire software without sacrificing the cost, schedule and performance goals of our acquisition programs.

Additionally, five focus teams, led by department software engineering professionals, have been established to achieve our strategic software goals (see attachment):

- Software Acquisition Management (SAM) Focus Team
- Software Systems Engineering (SSE) Focus Team
- Software Development (SWDEV) Techniques Focus Team
- Business Implications Focus Team
- Human Resources Focus Team"

ASN RDA Memo dtd May 15, 2006, subj: Software Process Improvement Initiative

Business Implications (BI)

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- **Accomplished – As Is and To Be**
  - **Contract Language policy memo signed 17 Nov 2006**
    - **Directs standardized contract language for all contracts containing software development, acquisition and life cycle support beginning with RFPs issued after 1 Jan 2007**
      - **Requires developers to submit Software Development Plan (SDP)**
  - **Contract Language Guidance policy memo signed 13 Jul 2007**
    - **Provides amplifying guidance information on the 17 Nov 2006 Contract Language policy memo**
- **Institutionalize**
  - **Re-enforced in the overarching Policy and Guidebook for Acquisition of Naval Software Intensive Systems – signed September 16, 2008**
  - **Update Contract Language based on future need**

Software Development Techniques (SWDT)

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- Accomplished – As Is and To Be
  - "Software Development Techniques Phase 1 Report" signed 10 Jul 2007
    - Provides an overview of existing software development techniques and suggestions for evaluating emerging software development techniques
    - Facilitates program managers software risk management
- Institutionalize
  - Guidebook for Acquisition of Naval Software Intensive Systems – signed September 16, 2008
  - Annual update to reflect maturity of existing techniques and emergence of new techniques

Software Systems Engineering (SSE)

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- **Accomplished – As Is and To Be**
  - Program Office Survey Findings Report promulgated July 2007
    - Report verifies the findings of previous studies (e.g., Defense Science Board (DSB)-2000 and Naval Research Advisory Committee (NRAC)-2006) by tracking them directly to current programs of record
  - Software Metrics White Paper – identified 4 core metrics
  - Develop software reviews for inclusion in Systems Engineering Technical Review (SETR)
- **Institutionalize**
  - Software Measurement for Naval Software Intensive Systems Policy – signed July 22, 2008
    - Provides a set of software metrics to assess program performance
  - Incorporate software reviews into SETR (planned March 2009)
    - Executing under Systems Engineering Stakeholders Group (SESG)

Software Acquisition Management (SAM)

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- **Accomplished – As Is and To Be**
  - "As Is" Report signed 17 May 2007
    - Uncovers the current environment for the acquisition of software intensive systems across the Naval Enterprise
    - Findings are consistent with past DSB and NRAC findings
  - "To Be" Report signed 6 Nov 2007
    - Assists acquisition professionals with a preview of key considerations for major problems having been found to be most troublesome and most commonly documented
- **Institutionalize**
  - Tailorable Organization Structure (included in Guidebook Sept 2008)
    - Tool for assessing organizational structure, software expertise, and staffing requirements for software intensive systems program offices
  - Software Measurement for Naval Software Intensive Systems Policy July 22, 2008
    - Provides a set of software metrics to assess program performance
  - Use the Systems Engineering Plan (SEP) and SETR (planned March 2009)
    - On-going effort through the SESG

Human Resources (HR)

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- **Accomplished – As Is and To Be**
  - "Role Base Right Fit Training" Report signed 6 Nov 2007
    - Addresses the training issues highlighted by the SAM focus team "As Is" state report, SSE focus team "Program Management Office Survey Findings," DSB, and NRAC findings
- **Institutionalize**
  - "Establishment of DAWIA Software Acquisition Training and Education Working Group" draft memo by OUSD(AT&L)
    - The "Role Base Right Fit Training" report serves as Naval input to OSD sponsored reviews of software acquisition management competencies for six acquisition disciplines (Program Management, Contracting, Acquisition Logistics, Systems & Software Engineering, and Legal)

Institutionalize – Guidebook

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- Signatory: ASN RDA
- Audience:
  - Primary: Government acquisition community
  - Secondary: Stakeholder community (e.g, developers)
- Objective:
  - To provide support to acquisition stakeholder team
  - Organize to capture focus teams products
  - Structure follows acquisition process timeline
- Status: Signed September 16, 2008

Institutionalize – Policy

RDA CHIEF SYSTEMS ENGINEER

- Signatory: ASN RDA
- Audience:
  - Primary: Government acquisition community
  - Secondary: Stakeholder community (e.g, developers)
- Objective:
  - Improve software acquisition processes

1. Software Measurement for Naval Software Intensive Systems
   - 4 core metrics
2. Overarching Software Process Improvement Policy for Acquisition of Naval Software Intensive Systems
   - Software Process Management Improvement
   - Contract Language
   - Software Measurement
   - Personnel experience or training
   - Ensure implementation and adherence to processes

- Status: signed July 22, 2008 & September 16, 2008

Weighting of Core Metrics Across Gates

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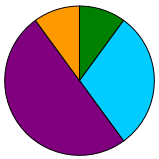
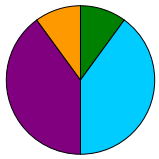
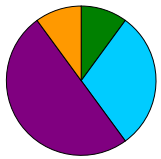
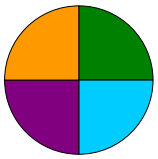
Core Metric	Gate 1 / Ph I: Concept Development	Gate 2 / Ph II: Concept Refinement	Gate 3 / Ph II: Concept Refinement	Gate 4 / Ph III: Technology Development	Gate 5 / Ph III: Technology Development	Gate 6 / Ph IV: System Development	Gate 6 Phase 2 / Ph V: System Demon-stration	Gate 6 Phase 3 / Ph VI: Production & Deployment	Gate 6 Phase 4 / Ph VII: Operations & Support
Size/ Stability	10%	10%	10%	20%	30%	25%	30%	30%	30%
Organ-ization	50%	40%	50%	40%	30%	25%	15%	15%	15%
Cost / Schedule	30%	40%	30%	25%	25%	25%	30%	30%	30%
Quality	10%	10%	10%	15%	15%	25%	25%	25%	25%
TOTAL	100% 	100% 	100% 	100% 	100% 	100% 	100% 	100% 	100% 

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Software Size/Stability Metric

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Phase	I	II	III	IV	V	VI	VII
Baseline/ Basis of Metric	Concept expectation of %-age of system functionality to be delivered by SW (vice, e.g., HW)	Concept expectation of %-age of system functionality to be delivered by SW (vice, e.g., HW)	SW Size Estimates	SW Size Baseline	SW Stability	SW Stability	SW Stability
Who Collects Measure-ments	Program Office	Program Office	Program Office / Bidders	SW developer/ integrator	SW developer/ integrator	SW developer/ integrator	Program Office / SW developer/ integrator
Who Analyzes	Program Office	Program Office	Program Office	Program Office / SW developer/ integrator	SW developer/ integrator	SW developer/ integrator	Program Office
Metric	%-age of functionality in SW	%-age of functionality in SW	Estimated SLOC, FP, or Req'ts.	ESLOC, FP, or Req'ts.	ESLOC, FP, or Req'ts.	ESLOC, FP, or Req'ts.	ESLOC, FP, or Req'ts.
Use of Metrics	Risk, Lessons Learned	Risk, Lessons Learned, Concept Selection	Risk, Lessons Learned, Source Selection	Risk, Lessons Learned, Performance	Risk, Lessons Learned, Performance	Risk, Lessons, Learned, Performance	Risk, Performance , Lessons Learned, Database/ Archival

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Software Cost/Schedule Metric

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Phase	I	II	III	IV	V	VI	VII
Baseline/ Basis of Metric	SW related IERs, SDXs	SW related IERs, SDXs	Actual SW cost & schedule data	Actual SW cost & schedule data	Actual SW cost & schedule data	Actual SW cost & schedule data	Actual SW cost & schedule data
Who Collects Measure-ments	Sponsors & Advocates	Sponsors & Advocates	Program Office /SW developer/ integrator	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator
Who Analyzes	Sponsors & Advocates	Sponsors & Advocates	Program Office	Program Office	Program Office	Program Office	Program Office
Metric	# IERs/SDXs produced by SW	# IERs/SDXs produced by SW	Cost/Schedu le Variance/ Performance index	Cost/Schedu le Variance/ Performance index	Cost/ Schedule Variance/ Performance index	Cost/ Schedule Variance/ Performance index	Cost/ Schedule Variance/ Performance index
Use of Metrics	Risk, Lessons Learned	Risk, Lessons Learned	Risk, Lessons Learned	Risk, Performance , Lessons Learned	Risk, Performance , Lessons Learned	Risk, Performance , Lessons Learned	Risk, Performance Lessons Learned

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Software Quality Metric

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Phase	I	II	III	IV	V	VI	VII
Baseline/ Basis of Metric	SW related IERS & SDXs	SW related IERS & SDXs	Defects per SLOC	Defects per SLOC, Defects per system interface	Defects per SLOC, Defects per system interface, Defects per system interface	Defects per SLOC, Defects per system interface, Defects per system interface	Defects per SLOC, Defects per system interface, Defects per system interface
Who Collects Measure-ments	Sponsors & Advocates	Sponsors & Advocates	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator	User/Tester	User/Tester
Who Analyzes	Sponsors & Advocates	Sponsors & Advocates	Program Office	Program Office	Program Office	Program Office	Program Office
Metric	% SW generated IERs/SDXs	% SW generated IERs/SDXs	Qty performance index/ variance	Qty performance index/ variance	Qty performance index/ variance	Qty performance index/ variance	Qty performance index/ variance
Use of Metrics	Risk, Lessons Learned	Risk, Lessons Learned	Risk, Lessons Learned	Risk, Performance , Lessons Learned	Risk, Performance , Lessons Learned	Risk, Performance , Lessons Learned	Risk, Performance , Lessons Learned

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Software Organization Metric

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Phase	I	II	III	IV	V	VI	VII
Baseline/ Basis of Metric	Effort/KSA	Effort/KSA	Effort/KSA/Turnover	Effort/KSA/ Turnover	Effort/KSA/ Turnover	Effort/KSA/ Turnover	Effort/KSA/ Turnover
Who Collects Measure-ments	Program Office	Program Office	Program Office / Bidders	Program Office / Contractor	Program Office / Contractor	Program Office / Contractor	Program Office / Contractor
Who Analyzes	Program Office	Program Office	Program Office	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator	Program Office / SW developer/ integrator
Metric	Planned # of people or planned # of labor hours, KSA	# of people or # of labor hours/actual trng vs required trng	# of people or # of labor hours/actual trng vs required trng/# of people lost & gained	# of people or # of labor hours/actual trng vs required trng/# of people lost & gained	# of people or # of labor hours/actual trng vs required trng/# of people lost & gained	# of people or # of labor hours/actual trng vs required trng/# of people lost & gained	# of people or # of labor hours/actual trng vs required trng/# of people lost & gained
Use of Metrics	Risk, Lessons Learned	Risk, Lessons Learned	Risk, Lessons Learned, Source Selection	Risk, Lessons Learned	Risk, Lessons Learned	Risk, Lessons Learned	Risk, Lessons Learned

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