

# **Practical Systems Measurement (PSysM)**



## **Systems Engineering Measurement Workshop**

*Office of the Under Secretary of Defense  
Acquisition and Technology*

*Joint Logistics Commanders  
Joint Group on Systems Engineering*

*International Council On Systems  
Engineering (INCOSE)*

PSM 1

23 Jul 98

# **Workshop Participants**

- *Bill Farr (Co-lead)*
- *Garry Roedler (Co-lead)*
- *Bruce Allgood*
- *Julie Bouchard*
- *Bill Bridges*
- *Jim Brink*
- *Darlene DeAngelo*
- *John Eget (telecon)*
- *Don Gantzer*
- *Ron Kohl*
- *Norm Kowalski*
- *Jim McGovern*
- *Chris Miller (telecon)*
- *Laurie Shifflet*
- *Dave Smith*
- *Ken Stranc*

**Very focused,  
hard-working,  
and  
knowledgeable  
group**

PSM 2

23 Jul 98

## **Restatement of Objectives**

- **Provide Background of the Practical Systems Measurement Project**
- **Review Selection Criteria of Common Issues, Categories, and Measures**
- **Review Current Candidates for Common Issues, Categories, and Measures**
- **Achieve Consensus on Terminology**
- **Review Draft Set of PSystem Measures**
  - *Did Not Accomplish*
- **Assess Current Plans for PSystem Guidance and Products**

## **Workshop Summary**

## **Issues, Categories, and Measures**

- ***Preliminary set of common issues, measurement categories, and measures (I-C-Ms) developed over past year served as main input for review and discussion***
- ***Reviewed selection process for I-C-Ms***
- ***Reviewed and refined selection criteria for I-C-Ms***
- ***Work in a Top-down manner reviewing I-C-Ms***

## **Issues, Categories, and Measures**

- ***I-C-Ms reviewed in detail against selection criteria and revised***
  - ***More focus on System Performance Measures***
  - ***One new issue and one revised issue***
  - ***Several changes to categories***
    - ***3 Deleted, 2 Added, and several renamed/reallocated***
      - ***Eliminated redundancy and address changes in Issues***
  - ***Total number of candidate measures reduced***
    - ***Several measures deleted, combined or reallocated***
      - ***Weeded out indicators, redundancies, and items not meeting criteria***
    - ***Added 3 new measures***

## PSysM Issue/Category/Measure Selection Process

- **Start with the PSM Issues, Categories, and Measures (ICMs)**
  - Complete
- **Remove or modify ICMs not applicable to Engineering a System**
  - Complete
- **Add candidate ICMs that are applicable to Engineering a System**
  - Complete
- **Establish selection criteria for ICMs**
  - Complete
- **Review list of candidate ICMs against established selection criteria and prioritize the list**
  - In-progress
- **Select ICMs for inclusion in guidance**

## PSysM Issue/Category Selection Criteria

- **Uniqueness**
  - Proposed new issue or category has little or no overlap in focus to the existing issues or categories
- **Simplicity**
  - Easy to understand and use
- **Relevance**
  - Relevant to most systems, program managers and systems engineers
  - Addresses the questions most managers and engineers need to answer
- **Lack of Fit Under Other Issues**
  - Scope of other issues and categories cannot be changed to accommodate the proposed issue or category

## **PSysM Selection Criteria for Measures/Indicators**

- **Past Success**
  - *Proposed new measure has been used successfully by multiple users (where success means yielding useful insight into the issues and supporting decision making)*
- **Non-proprietary**
  - *Available for public use*
- **Simplicity**
  - *Easy to measure and use; data is accessible*
- **Relevance**
  - *Relevant to most systems, program managers and systems engineers*
  - *Addresses questions most managers and engineers need to answer*
- **Repeatable and Unambiguous**
  - *Can be defined in sufficient detail such that collectors, analysts, and users of the data agree on the meaning*
- **Uniqueness (secondary filter only)**
  - *Proposed new measure has little or no overlap in focus to the existing measures*

## **Systems Common Issues**

- **Schedule and Progress**
- **Resources and Cost**
- **Functionality \***
- **Product Quality**
- **Life Cycle Process \***
- **System Performance \*\***
- **Technology Effectiveness \***
- **Customer / User Satisfaction \*\***

\* Modified from PSM \*\* Not currently in PSM

## PSysM Issues and Measurement Categories

- Schedule and Progress
  - Work Unit Progress
  - Schedule Performance
- Resources and Cost
  - Personnel
  - Financial Performance
  - Other Resources
- Functionality
  - Size
  - Stability
- Product Quality
  - Defects
  - Failures
  - Defect/Failure Recovery (Rework, Restore, Fix)
- Life Cycle Process
  - Process Evaluation
  - Productivity
  - Process Mgt Effectiveness
- System Performance
  - System Effectiveness
  - Product Characteristics
- Technology Effectiveness
  - Technology Evaluation and Assessment
  - COTS/GOTS/NDI/Reuse
- Customer / User Satisfaction
  - Customer / User Feedback - Satisfaction With Solution
  - Customer / User Feedback - Satisfaction With Engrg Team

## PSysM Mapping of Issues, Categories, and Measures

ISSUE	CATEGORY	MEASURES
Schedule and Progress	Work Unit Progress (at each level of the system hierarchy)	Problem Report Status (by attribute) Action Item Status (includes action from audits) TBDs/TBRs Status Issue/Risk Status (includes attributes of identification and mitigation) System Element Status (includes attributes of design, build, integration, test, and delivery) Requirements Status (% Derived, allocated, validated, verified, and delivered) Life Cycle Activity Status (status includes Defined, Reviewed, and Executed) <ul style="list-style-type: none"> <li>■ Design</li> <li>■ Integration</li> <li>■ Test</li> </ul> Reviews/Audits Completed Change Request Status (Baseline Changes Requested, Approved, and Incorporated)
	Schedule Performance (corresponds to Milestone Performance in PSM 3.1)	Milestone Dates Number of Schedule Dependencies for a Task Amount of Lead/Slack Time Length of Critical Path

***PSySM Mapping of Issues, Categories, and Measures***

<i>ISSUE</i>	<i>CATEGORY</i>	<i>MEASURES</i>
Resources and Cost	Personnel	Effort (per task or product by type)
		Staff Experience
		Staff Availability (includes turnover)
	Financial Performance	Cost
		Earned Value
	Other Resources (Corresponds to Environment Availability in PSM 3.1)	Resource Quantity (per task or product by type)
		Resource Availability
Functionality	Functional Size	Requirements (number and %)
		Architecture Elements
		Design Elements
		Object Classes
	Functional Stability	Requirements Added, Deleted, or Changed (number and %)
		Number of TBDs/TBRs per Document
		Requirements Traceability (includes traceability to specifications, design, test plans, etc.)
		<ul style="list-style-type: none"> <li>■ Top-down (Childless Requirements)</li> <li>■ Bottom-up (Parentless Requirements)</li> </ul>

***PSySM Mapping of Issues, Categories, and Measures***

<i>ISSUE</i>	<i>CATEGORY</i>	<i>MEASURES</i>
Product Quality	Defects	Problem Reports (attribution needed; includes opened, closed, aging, severity/priority, type, element, etc.)
		Defects (by attribute; e.g., severity)
	Failures	Failures (by attribute; e.g., severity)
		Failure Interval or Times (by attribute)
	Defect/Failure Recovery (rework, restore, fix)	Recovery Time Duration
		Recovery Size
Life Cycle Process	Process Evaluation	Recovery Effort and Resources
		Capability Level for Each Process Area or Focus Area
		Process Count (includes total, number defined, number changed)
		Compliant Processes or Plan Items
	Productivity	Product Size Per Effort Ratio
		Functional Size Per Effort Ratio
	Process Management Effectiveness	Process Efficiency
		Cycle Time
		Planning Changes (schedule & resources)
		Effectiveness of Process Tasks <ul style="list-style-type: none"> <li>■ Risk Mgt Tasks</li> <li>■ Reviews/Inspections</li> <li>■ CM Tasks</li> <li>■ Planning</li> <li>■ Tracking</li> <li>■ etc.</li> </ul>

**PSysM Mapping of Issues, Categories, and Measures**

<i>ISSUE</i>	<i>CATEGORY</i>	<i>MEASURES</i>
System Performance	System Effectiveness	System / Element Capacity
		System / Element Throughput
		System / Element Utilization
		Turnaround Time
		Response Time
		Usability (number of informational items, user interface devices, operational tasks, operator decisions)
	Product Characteristics	Efficiency
		Elements (by type including HW, SW, model components, COTS/GOTS/NDI/Reuse items, etc.)
		Interfaces
		Database Size
		Physical Characteristics (varies by specific domain and includes, but not limited to memory, capacity, weight, dimensions, power, temperature, and strength)

**PSysM Mapping of Issues, Categories, and Measures**

<i>ISSUE</i>	<i>CATEGORY</i>	<i>MEASURES</i>
Technology Effectiveness	Technology Evaluation / Assessment (corresponds to Technology Impacts in PSM 3.1)	Risk/impact of the technology (technical, cost, and schedule)
		Relative adequacy for application (includes criteria such as scalability and expandability)
	COTS/GOTS/NDI/Reuse	Functionality that can be handled by COTS/GOTS/NDI/Reuse
		Commercial Product Stability
Customer / User Satisfaction	Customer / User Feedback - Satisfaction With Solution	Quantity of Interface Elements Required (e.g., amount of glue code)
		Survey Results
	Customer / User Feedback - Satisfaction With Engineering Team	Number of Commendations / Complaints
		Award Fee Amounts
		Survey Results
		Number of Commendations / Complaints



## **Life Cycle Terminology Discussion**

- **Considered all current and in-process SE standards**
- **Agreed to adopt life cycle terminology from EIA 632, version 1.0, as basis for phases and processes**
  - **Will also account for O&M and Disposal in phases; not covered in EIA 632**

## **Conclusions, Recommendations, and Results**

- **Obtain necessary support for the project**
- **The systems measurement information is very necessary**
- **Important to resolve I-C-Ms before proceeding too far in defining measurement tables**
- **Map I-C-Ms against requirements in EIA 632 and 731 as a completeness check**
- **Should start detailed definition of Issues and Categories**
- **Refine Progress and Schedule “status” measure definitions to agree with selected life cycle terminology**
- **Coordinate with other PSM IPTs and study groups to ensure consistency and leverage applicable work**
- **Continue to look at the I-C-M structure from both Top-down and Bottom-up perspectives**

## **Conclusions, Recommendations, and Results**

- *Identify candidate measures that link to activities/ requirements of EIA 632 and 731 (longer term reco.)*
- *Review training materials and Insight tool to determine what is needed to accommodate Systems perspective, as well as software*
  - *Start revision, as soon as possible*

## **Proposed Versions and Content**

### **Version 1:**

- *Extend PSM to Systems*
- *Adjust Issues, Measurement Categories, and Measures*
- *Develop for General Audience*
- *Tradeoff Analysis*
- *Risk Analysis for Systems*
- *Link Between Systems and SW Measurement*
- *Case Studies*

### **Future Version(s):**

- *Additional Measures*
- *Decision Support Analysis*
- *Additional Case Studies*
- *Incorporate Lessons Learned*
- *Measures Related to Systems Engineering Capability Model*
- *Measurement Integration*
- *System/Software Interface Measures*
- *Additional Focus on “ilities”*
- *Product Engineering for Systems*

## Proposed Next Steps

- Present Results to INCOSE MWG at Symposium on 27 July 1998
- Complete Definitions of Measures
- Resolve Guidance Format Decision
- Continue to Seek Additional Support
- Use SE Standard as a Checklist
- Develop Indicator Examples
- Develop Relationship Between Measurement and Tradeoff Analysis
- Develop Case Studies

## Proposed Tasks & Schedule

<u>Development Task</u>	<u>Scheduled Completion *</u>
• Project Plan	• DEC 97 (Done)
• Guidebook Outline	• FEB 98 (Done)
• Identify Issues, Measurement Categories and Measures	• MAY 98 (Done)
• Specify Categories & Measures	• OCT/NOV 98 (In-progress)
• Draft Case Studies	• DEC 98
• First Writers Week	• NOV 98
• Draft PSystem Guidance	• JAN 99
• 2nd Writers Week	• FEB 99
• Draft Training	• FEB 99
• Promotional Briefings /Papers	• As required
• Release of PSystem Guidance	• APR 99
• Training Course Complete	• MAY 99

\* Dates dependent on full project support by 1 OCT 98

## **Logistics**

- **Meeting Frequency**
  - **Approximately every other month**
- **Meeting Location**
  - **Usually based in Reston, VA**
  - **Always provide for Teleconference via "800" dial-in**
- **Means of Communication**
  - **Email distribution**
- **Next Meetings**
  - **22 SEP 98 1 - 5 PM**
  - **2 NOV 98 1 - 5 PM**