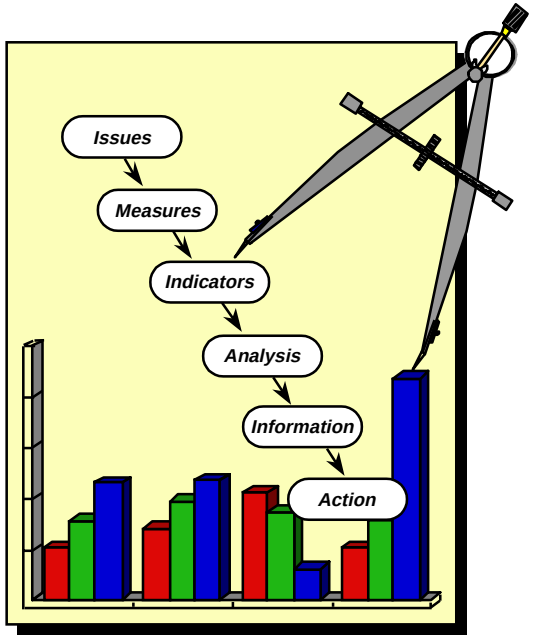
Practical Software Measurement

A guide to objective program insight



Systems Engineering Measurement

July 24, 1997

Joint Logistics Commanders
Joint Group on Systems Engineering

Office of the Under Secretary of Defense
Acquisition and Technology

Systems Engineering Measurement Workshop Participants

- Garry Roedler
- Bill Farr
- Don Gantzer
- Chris Miller
- John Gaffney
- Bruce Allgood
- Dennis Ahern
- Richard Tessmer
- Charles Talley
- Alison Ferraro
- John Eget
- Bill Bridges
- Dan Reiling
- Shawn Bishop

Restatement of Objectives

- *Identify Initial User Requirements To be Addressed in PSysM*
- *Assess Current Plans for PSysM Guidance and Products - Identify Realistic Schedule and Content for Planned Product Versions*
- *Establish Basis for Joint INCOSE - PSM Approach to Systems Engineering Measurement*
- *Establish PSysM Project Plan*

Workshop Summary

PSysM Project Objectives

PSM	PSysM
• Help Program Managers Meet Software Cost, Schedule, and Technical Objectives	• Help Program Managers Meet Systems Cost, Schedule, and Technical Objectives
• Provide a Basis for Objective Communication and Informed Decision Making	• Provide a Basis for Objective Communication and Informed Decision Making
• Establish a Foundation for Executive Level Performance Measurement	• Establish a Foundation for Executive Level Performance Measurement
	• Integrate with the PSM and INCOSE Product Lines

Initiative Scope

PSM	PSysM
• DoD SW Measurement Needs	• Systems Measurement Needs
• Target Audience is DoD Program Mgr and Development Team	• Target Audience is Program Mgrs, Systems Engineers, and Life Cycle Teams*
• AIS, C3I, and Weapon Systems Programs	
• New and Existing Program Implementations	• New and Existing Program Implementations
• Life Cycle Application - All DoD Programs, All Phases	• Life Cycle Application - All Programs, All Systems, All Phases
• Single SW Program Analysis	• Single Program/System Analysis
• Fundamental Practices - "How To" Guidance	• Fundamental Practices - "How To" Guidance

* Life Cycle Teams are the various teams involved in the acquisition, systems engineering,development, maintenance, support, etc. of the system.

Key Concepts

PSM	PSysM
• Views Measurement as a Process, not a Pre-Defined List of Measures, Graphs, or Reports	• Views Measurement as a Process, not a Pre-Defined List of Measures, Graphs, or Reports
• Defines a Systematic Method for Selecting Appropriate Measures that address program specific issues	• Defines a Systematic Method for Selecting Appropriate Measures that address program/system specific issues
• Defines a Systematic Method for Analyzing Data incorporating the use of independent analysis to Assess Issues/Risks	• Defines a Systematic Method for Analyzing Data incorporating the use of analysis independent of the data/analysis provider to Assess Issues/Risks
• Effective Program-Level Measurement is a Prerequiste for Enterprise and Process Measurement	• Effective Program-Level Measurement is a Prerequiste for Enterprise and Process Measurement

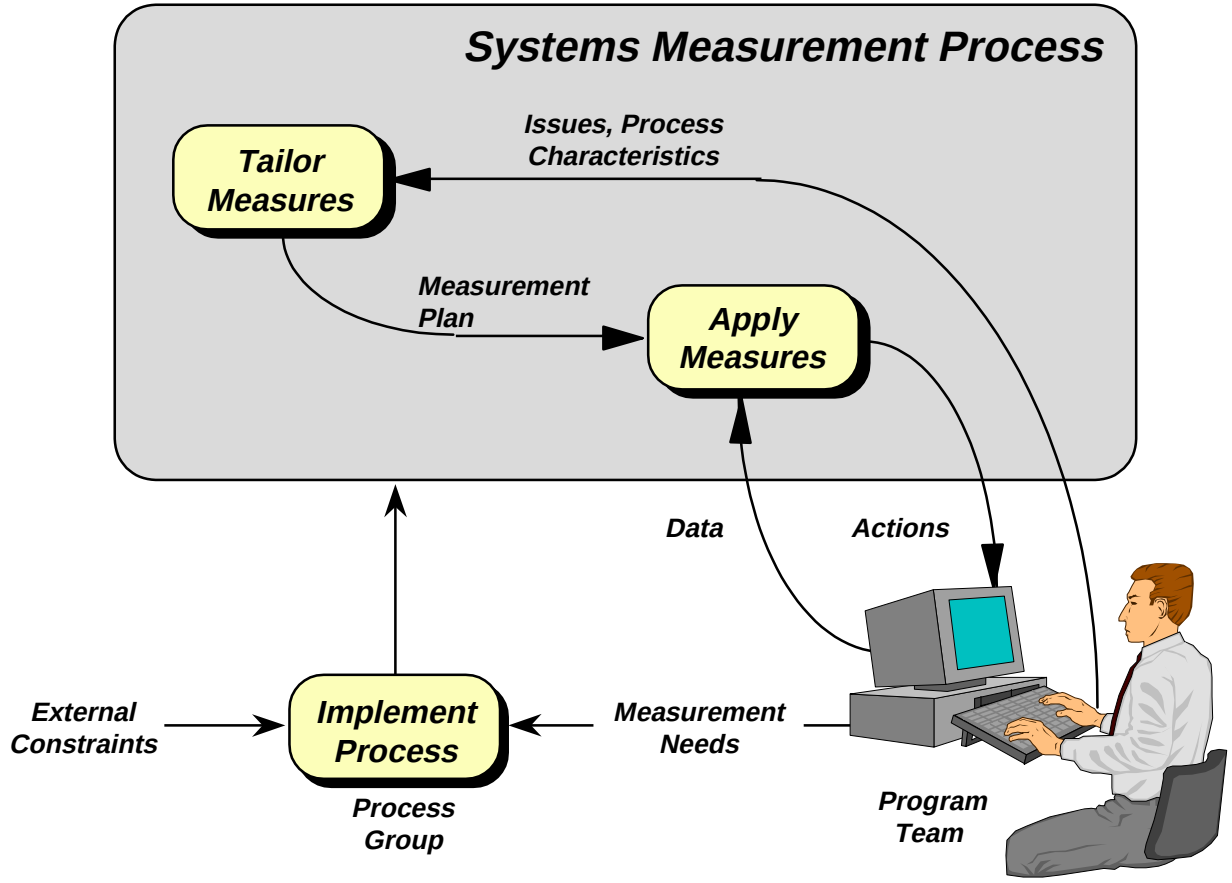
Measurement Principles

PSM	PSysM
• Program Issues and Objectives Drive the Measurement Requirements	• System/Program Issues and Objectives Drive the Measurement Requirements
• The Developer's Process Defines How the Software is Actually Measured	• The Life Cycle Process Defines How the System/Program is Actually Measured
• Collect and Analyze Data at a Level of Detail Sufficient to Identify and Isolate Software Problems	• Collect and Analyze Data at a Level of Detail Sufficient to Identify and Isolate Problems
• Implement an Independent Analysis Capability	• Implement an Analysis Capability Independent of the Data/Analysis Provider
• Use a Structured Analysis Process to Trace the Measures to the Decisions	• Use a Systematic Analysis Process to Trace the Measures to the Decisions

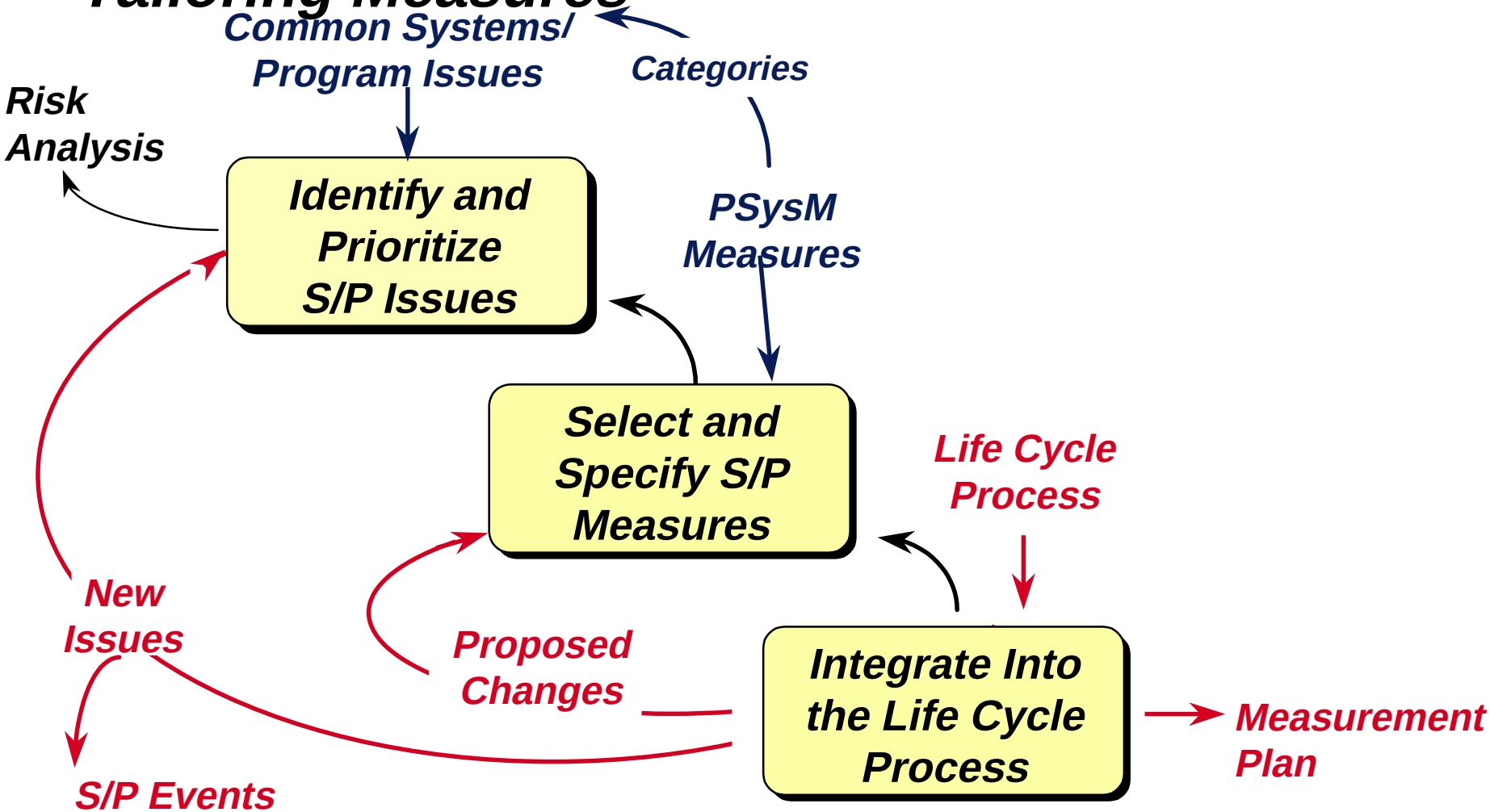
Measurement Principles

PSM	PSysM
• Interpret the Measurement Results In the Context of Other Program Information	• Interpret the Measurement Results In the Context of Other System/Program Information
• Integrate Software Measurement Into the Program Management Process Throughout The Life-Cycle	• Integrate Systems/Program Measurement Into the Entire Life-Cycle Process
• Use the Measurement Process as a Basis for Objective Communications	• Use the Measurement Process as a Basis for Objective Communications
• Focus Initially on Single Program Analysis	• Focus Initially on Single System/Program Analysis

Systems Measurement Activities



Tailoring Measures



Common Issues

- Schedule and Progress
- Resources and Cost
- S/P Performance (added)
- Growth and Stability
- Product Quality (consider "Systems Quality")
- Life Cycle Process (Broader than "Development Performance")
- Technical Adequacy (consider "Technology Effectiveness")
- Customer / User Satisfaction (added)

Issues and Measurement Categories

- Schedule and Progress
  - Milestone Performance
  - Work Unit Progress
  - Schedule Performance
  - Incremental Capability

- Resources and Cost
  - Effort Profile
  - Staff Profile
  - Cost Performance
  - Environment Availability *(consider "Other Resources")*

Issues and Measurement Categories

- ***S/P Performance*** ***(added)***
  - ***"ilities"***
  - ***TPMs***
- ***Growth and Stability***
  - ***Systems Size and Stability***
  - ***Operational System Resource Utilization***
- ***Product Quality*** ***(consider "Systems Quality")***
  - ***Defect Profile***
  - ***Failure Profile***
  - ***Complexity***

Issues and Measurement Categories

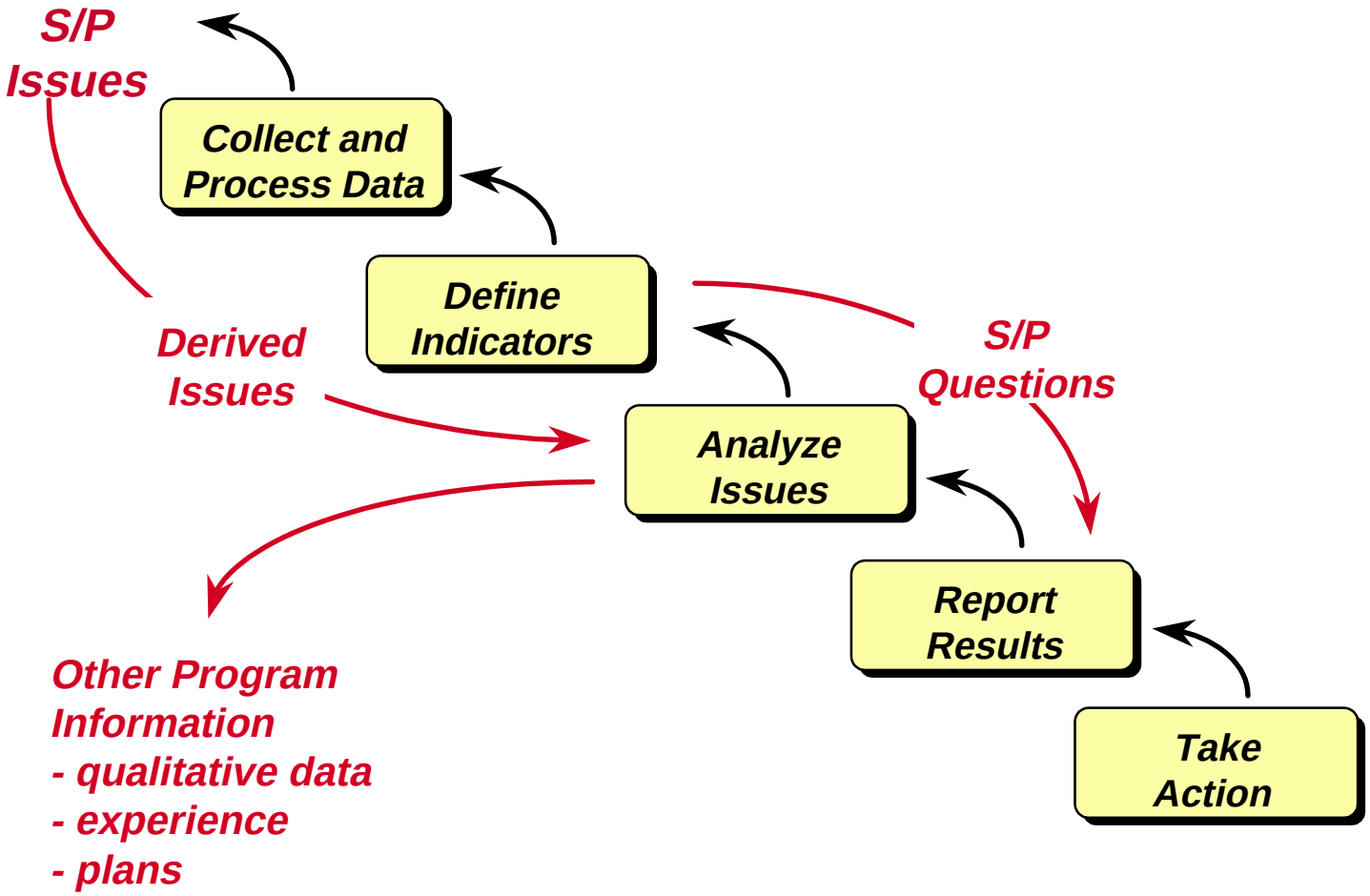
- ***Life Cycle Process*** ***(Broader than "Development Performance")***
  - ***Process Maturity***
  - ***Productivity***
  - ***Rework***
  - ***Coordination***

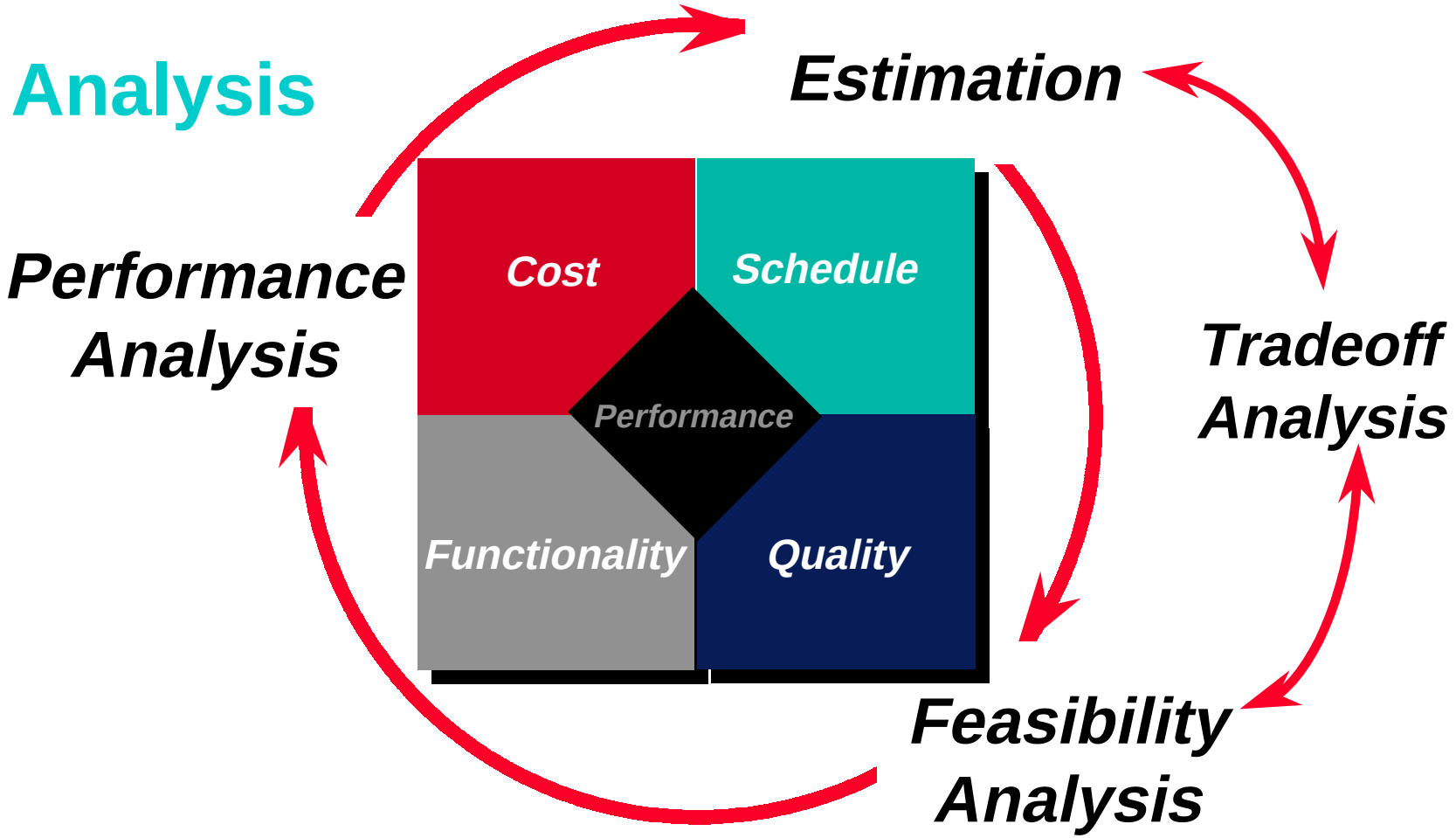
Issues and Measurement Categories

- ***Technical Adequacy*** ***(consider "Technology Effectiveness")***
  - ***Technology Impacts***

- ***Customer / User Satisfaction*** ***(added)***
  - ***Customer / User Feedback***
  - ***Human Factor Measures***

Applying Systems Measures




Analysis
Estimation
Performance Analysis
Tradeoff Analysis
Feasibility Analysis
Cost
Schedule
Performance
Functionality
Quality

Link Between Software and Systems

- For Issues, Measurement Categories, and Measures regarding software components of the system, reference will be made to the PSM guidebook.

- Further detail or additional links will be defined later.

Same Products Are Proposed For PSysM

PSysM Products

Technical Guidance

- Separate Guidebook

Measurement Workstation -

Incorporate Systems Measures into Insight

Training Courses -

Adapt Current Course for Systems

Collaborative Development Approach

- Build on Current Products and Experience of PSM, INCOSE, and Development Partners
- Documentation
  - Use PSM process concepts and documentation directly
  - Account for differences between SE and SW
  - Use example metrics from current INCOSE guidebook and other sources
- Training
  - Reuse much of existing training materials
  - Training with same constraints as current PSM trainers

General Guidance

- Focus on Technical Consensus
- Recommendations based on proven practices and measures
- Development and products will be consistent with PSM product line, approach, and philosophy
  - Must dovetail with PSM to be an integrated set
- Clear and understandable guidance

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 Measurement and SW Measurement
- Case Studies

Future Version(s):

- Additional Measures
- Decision Support Analysis
- Additional Case Studies
- Incorporate Lessons Learned
- Measurement Integration
- Additional Focus on “ilities”

Proposed Tasks & Schedule

Development Task	Scheduled Completion
• Project Plan	• AUG 97
• Concept Outline	• SEP 97
• Detailed Outline	• NOV 97
• Identify/Define Measurement Categories and Measures	• JAN 98
• Specify Categories & Measures	• APR 98
• Draft Case Studies	• APR 98
• First “Hell Week”	• JUN 98
• Draft PSysM Guidebook	• JUL 98
• 2nd “Hell Week”	• SEP 98
• Draft Training	• OCT 98
• Promotional Briefings /Papers	• As Required
• Version 1.0 of PSysM Guidebook	• NOV/DEC 98
• Training Course Complete	• DEC 98/JAN 99

PSysM Organization Structure

Support Commitments (TBR)

Writer's Group	Study Group / Integrated Product Team	
• Garry Roedler	• Garry Roedler	• Dave Card
• Bill Farr	• Bill Farr	• Florence Beckmann
• Sharon Rohde	• Sharon Rohde	• Alan Weinberger
• Don Gantzer	• Don Gantzer	• Dennis Brink
• Patrick Antony	• Patrick Antony	• Richard Tessmer
• Chuck Mills	• Chuck Mills	• Charles Talley
• Jeanmarie MacLean	• Chris Miller	• Alison Ferraro
• Terry Treadwell	• John Gaffney	• John Eget
• Alison Ferraro	• Jeanmarie MacLean	• Bill Bridges
• John Gaffney	• Terry Treadwell	• Dan Reiling
	• Bruce Allgood	

Reporting and Coordination

- Quarterly Reports to PSM TSG
  - Status: Progress, Issues, Risks, Etc.
- Study Group Leadership Coordination
  - Participate in TSG
  - Coordinate With Other Study Groups and Existing PSM IPTs
- PSM TSG Oversight
  - Final Review and Approval

Logistics

- Meeting Frequency
  - WG - 2 day meeting every 2 months
  - IPT - 1 day meeting every 2 months
- Meeting Location(s) - Variable, but centered in Washington DC area
- Mode of Meetings
  - Traditional
  - Teleconference
  - Video Teleconference
- Means of Communication
  - Email, fax, and phone

Conclusions And Recommendations

- Strong support within workshop for this effort
- PSM process is valid and can be reused with only minor adaptations for systems
- Systems measurement has broader scope
- Consider changing a few terms as noted in PSM
- Ensure IPT includes people with experience in multiple disciplines and full life cycle
- Proceed with PSysM Project

Next Steps - Action Items

- Coordinate with INCOSE MWG at Symposium
- Project Plan Completion and Approval
- Formation of Study Group / IPT
- Selection of Writers Group
- Prepare Concept/Draft Outline
- Prepare Detailed Outline