# Measurement Tailoring Workshops

## Introduction
The Director of Information Systems for Command, Control, Communications, and Computers (DISC4) policy memorandum of 19 September 1996, reference (a), eliminated the requirement for mandatory metrics and initiated a program for issue-driven measurement on all Army software-intensive systems. The Army Software Metrics Office (ASMO) supported this policy in collaboration with the Practical Software Measurement (PSM) project, a DoD-wide, issue-driven software measurement program. Since 1996, the ASMO has been a leading sponsor of the PSM project and provides a wide range of services and products to support Army managers in implementing issue-driven software measurement in their projects. One of the most useful services of the ASMO is to facilitate the first step in the issue-driven process, which is to define the project issues that will be addressed by the software measurement program. This article provides a roadmap to conduct an effective Measurement Tailoring Workshop.

## Measurement and Project Management
The measurement tailoring process is based on the guidance presented in the PSM Guide, reference (b), and includes these activities:
   a. describe the overall system management project, with emphasis on the software process and product characteristics;
   b. identify the objectives and risks of the project as issues for the software measurement program;
   c. prioritize the project issues that are to be supported by software measurement;
   d. select an effective set of software measures to support the issues, and tailor them to the developer's process;
   e. define an action plan to implement the software measurement program in the organization.

A workshop is the best forum to achieve these objectives, since the people, organizational structure, and real-time events in a project will drive the management issues. Identifying the underlying causes of issues requires a brainstorming effort and discovery process with representatives from all elements of the project. Project issues often become clear through a better understanding of the organizational tasks and issues that face the system and software managers.
This article covers the following Measurement Tailoring Workshop topics:
   a. Preparing for the Workshop
   b. Opening the Workshop
   c. Conducting the Workshop: Identifying Issues and Measures
   d. Implementing the Workshop Results
   e. Following up on Workshop Results

### *Preparing for the Workshop*
Planning an effective workshop requires a step-by-step process that is best supported by a checklist. A detailed checklist for a Measurement Tailoring Workshop can be found on the ASMO Web site <http://www.ArmySoftwareMetrics.org>, or can be obtained by

contacting the ASMO office by either e-mail at loeschjonathan@hq.optec.army.mil or phone at 703-681-3823.

The first, and probably the most important, step for a Measurement Tailoring Workshop is to identify the facilitators who will set up and conduct the workshop. At least two experienced facilitators should be available for each workshop. Two people are needed during the workshop: one to take detailed notes while the other leads group discussions. The facilitators should plan their roles as lead and backup facilitator for each agenda item, since their roles may change according to their experience with the different agenda topics.

The facilitators should have either experience with or knowledge of the project and the organization prior to the workshop. They should at least understand the top-level system requirements, organizational structure, project background, and as much of the unique project nomenclature as possible. It is also essential that both facilitators have first-hand experience with the issue-driven PSM process, and at least one should have participated in a Measurement Tailoring Workshop. If possible, the facilitators should have some training in formal facilitation techniques.

Prior to the workshop, the facilitators should develop an internal workshop plan and schedule to ensure that all objectives are achieved. The plan and schedule will be driven by the complexity of the software process, the organization, and the project history. ASMO's experience has proven that most projects require two days for a comprehensive workshop. Those projects that host a one-day Measurement Tailoring Workshop must complete all activities during a single meeting, including identifying and prioritizing their issues, selecting an appropriate set of measures, and drafting the initial measurement plan. The ASMO has also found that an iterative series of short, half-day workshops can be effective. However, the multiple workshop approach will delay implementing a measurement program and has the risk of personnel turnover between workshops.

Selecting workshop participants requires an understanding of the project organization and insightful judgment to achieve a balance between the size of the group and effective representation of all management activities. The workshop should not have too many participants and should allow input from all persons who are invited. However, the number of participants should provide a cross-section of the many management activities that impact the project. The ASMO has found that workshops with more than 20 participants are too crowded to be effective. To encourage active participation, everyone that is invited should understand the benefits that can be obtained from the issue-driven measurement process.

The most important element in staffing a Measurement Tailoring Workshop is to ensure that all participants understand their roles and objectives. The participants should realize that their primary task in the workshop is to define their local management issues and information needs. Each individual should be prepared and willing to provide their interpretation of management problems and risks within the overall organization.

*Opening the Workshop*
The opening of the workshop should ensure that all participants have the information and motivation to effectively participate in the discussions. In their opening remarks, the workshop leaders should:
   a. provide an overview of the issue-driven measurement process with a slide presentation that can be obtained from the ASMO;
   b. allow all participants to introduce themselves;
   c. review the workshop agenda and schedule;
   d. identify the workshop objectives and scope;
   e. describe the workshop approach, stressing the need for all persons to participate and represent their management or technical activity in the organization;
   f. describe the ground rules that will be followed in the workshop.

The objective of most workshops is to define appropriate management issues and software measures that will address those issues. It is helpful for the workshop facilitators to narrow the scope of the workshop discussions to focus on specific issues for each level of the organization. The facilitators should clearly define the scope of the workshop by describing the elements of the organization that will be addressed, the products that will be considered, and the limits of the system and software management systems.

In describing the workshop approach, the facilitators should stress the need for all persons to participate in the discussions. Participants must understand that they represent their local management or technical activity and must assert themselves to define the specialized procedures and information needs of their activity.

Establishing and following a set of ground rules will also help to achieve a productive workshop. Discussing an organization's working relationships and project history can often become an emotional and contentious exercise. The facilitators should remind everyone of the need for open and candid discussions, and the need to avoid personal attacks or attribution of any remarks to any person or element of the organization. Since a workshop should represent various management levels, all participants must be assured that their remarks will not be held against them or be attributed to them in a record of the workshop. Participants should also be reminded to keep their discussion within the defined scope of the workshop. The facilitators should stress that all participants are in the workshop to do the right thing by identifying issues and problems, but that the confidentiality of all remarks will be assured.

Finally, the workshop facilitators must ensure that everyone's expectations of the benefits available from the workshop and measurement program are realistic.

**Conducting the Workshop to Identify Issues and Measures**
A workshop should follow an open format that will allow candid discussion by the participants. The facilitators should promote an open forum, but guide the discussions to develop a tailored set of issue-driven measures. Tailoring is a three-step process:
   a. identify project management issues;
   b. prioritize the issues;

c. define the measures that will support management of the issues.

### *Identifying Project Issues*

Identifying the project management issues is facilitated with an open discussion of the existing management structure. The facilitators should encourage all participants to describe their view of the project, including:

a. the software management effort that supports the overall system acquisition or maintenance project;
b. the system and software management objectives and procedures that guide their daily work;
c. interfaces with other organizations that impact software management processes;
d. project history;
e. allocation of resources within the project;
f. technical architecture and characteristics of the software;
g. project schedule and current status;
h. existing measurement data collection procedures, information systems, and reports;
i. risk management plans and reports.

In addition to an open discussion of individual management procedures, the facilitators may conduct a more structured analysis of management information issues by reviewing:

a. the software management structure and processes in the organization and project;
b. existing software management information systems at various levels in the organization;
c. the project risk management process.

Usually, this discussion of the existing organization and management structure will identify most of the significant issues in a project. To either stimulate discussion in a quiet group, or to ensure completeness of a good discussion, the facilitators should review the list of common software issues that are defined in the PSM Guide:

a. Schedule and Progress;
b. Resources and Cost;
c. Growth and Stability;
d. Product Quality;
e. Development Performance;
f. Technical Adequacy.

These common software issues can be compared and mapped to the project issues that have been identified. A discussion of each of the common issues may jog the memory of the participants to identify other project issues.

### *Prioritizing the Issues*

The next step in tailoring is to prioritize the issues according to their importance to the overall project management effort. Not all issues are equally important, and they must be prioritized to determine where to focus the measurement effort. Prioritization can be as simple as a rank ordering of issues in terms of their expected impact. The ranking should

consider the magnitude of known problems, the risk exposure, and the potential impact on the project due to the lack of adequate information.

Since each project will determine the importance of the defined issues, there is no formula or standard procedure to prioritize issues. The facilitators may define issue-prioritization rules and techniques and may publish prioritization criteria for use during the workshop. Prioritization is based on the consensus reached through group discussions. Several existing sources of information may be used to support prioritization, including:

a.  personal experience of the workshop participants;
b.  results of a project risk management process;
c.  system and project constraints and objectives, such as an aggressive schedule;
d.  software technologies that have been selected to solve project problems, such as COTS;
e.  product acceptance criteria, such as resolution of all Priority 1 and 2 Software Trouble Reports (STRs);
f.  external requirements, such as changes in customer policy or the need for design portability into future systems.

### *Defining the Measures*
The last step in the tailoring process is to develop an initial set of measures to address the defined project issues. Once the project-specific issues have been identified and prioritized, appropriate measures must be selected to track them. A measure is a quantification of a characteristic of a software process or product. Many different measures may apply to an issue. However, in most cases it is not practical to collect all (or even most) of the possible measures for an identified issue.

Identification of the "best" measures for a project should be based on a systematic evaluation and trade-off between the measures that can support the defined project issues and data that can be effectively derived from the existing management processes. To assist in selecting a set of issue-driven measures, the PSM Guide provides a three-step process that guides the user through a sample set of issues, categories, and measures. This "I-C-M" process is performed to define a candidate set of measures to address the project issues:

First, the user reviews the defined project-specific issues and maps each issue to one of the six PSM common issues. The PSM common issues help the user arrange the project-specific issues into pre-defined categories.

Second, from the measurement categories that are defined for each of the six PSM common issues, the user selects a measurement category that is applicable to each project-specific issue. PSM measurement categories identify a group of related measures that provide similar "types" of information about a project issue.

Third, appropriate measures are selected from the list of measures within each selected category. The sample PSM measures are those that have proven to provide the right quantitative data to effectively address an identified issue.

The measurement selection process should continue to determine which of the sample I-C-M measures can be effectively collected in the project. The measurement set that is rather quickly identified during a workshop must be recognized as only a starting point. The measures that are defined by the small workshop group will be refined as the measures are integrated into the existing software development and management processes. The measures should be refined by tailoring the specific data definitions to data elements that can be derived through the project's existing management process. However, the information objectives of the defined measures to support the project issues must not be changed. The key to refine the measures is to provide the same information support for the issues, but use the data that can be effectively obtained in the organization. The end result is a set of software measures that are directly mapped to the project issues and can be effectively derived from the existing software development process.

### Implementing the Workshop Results
The results of a Measurement Tailoring Workshop are typically documented in a draft software measurement plan.

A draft software measurement plan should list the project-specific issues and the measures required to address these issues. The utility of the plan is to describe the process to collect and analyze the data. The plan should also explain how the developer and acquisition managers will use the measurement results for decision making and communication within the project. The software measurement plan that is identified in a workshop will be an informal draft. The plan will be modified as the initial measures are further refined in terms of data elements that can be effectively provided with existing software processes.

A workshop may only allow the effort that is needed to draft an outline of a software measurement plan. The facilitators may develop a generic outline and work with the workshop participants to tailor it. The important point is that everyone in the workshop has an opportunity to provide recommendations for the software measurement plan. Group consensus will define the first draft of the plan. The detailed notes that were taken during the workshop to define the issues and measures will be incorporated into the plan.

### Following Up on Workshop Results
Follow-up activities from a workshop should include a continuous effort to evaluate and refine the selected software measures. Refinement of the initial recommended measures from the workshop is based upon a detailed review of the existing systems engineering and software development processes, and identification of data requirements and associated measurement and reporting mechanisms. The final results will be documented in an iterative update of the project's software measurement plan.

After the workshop, the initial software measurement plan will be updated to include the general measurement requirements for the selected measures, shown in Table 1.

**Source Data** – Source-level measurement data representing plans, changes to plans, and actuals for each measure will be collected and reported.

**Exit Criteria** – All actual measures will be defined in terms of measurable exit criteria. All aspects of the exit criteria must be satisfied for the event, activity, or product to be counted as complete.

**Definitions** – All measures and data items will be explicitly defined with respect to measurement methodology, assumptions, and exit criteria. Separate definitions for estimated/planned data and actual data will be provided if warranted. Changes over time will be identified. Definitions and methodologies will be consistent with organizational management and technical processes.

**Data Aggregation Structures** – Data aggregation structures will be defined for all data items. These will include software design structures, work breakdown structures, and functional structures as applicable. Changes to such structures will be identified. Design components will be mapped to applicable functions.

**Measurement Indicators** – Measurement indicators (graphs and reports) based on aggregations of data will summarize direct measurements. Averages over many components or measures or results expressed in percentages will not be used, except for CPU utilization.

**Periodicity** – Measurement data will be collected on a periodic, not event-driven basis. This will be monthly unless otherwise stipulated.

**Data Dates** – For each measure, both the date that the measurement data was collected and the date that it is reported will be identified.

**Data Reporting Mechanisms** – The developer will identify the data reporting and transfer mechanisms for each measure. Use of automated data access and transfer will be made a priority.

**Measurement Points of Contact** – Each organization will identify a measurement point of contact.

**Table 1. The initial software measurement plan will include the general measurement requirements for the selected measures.**

**References**
(a) Memorandum, Director of Information Systems for Command, Control, Communications and Computers (DISC4 SAIS-ADW), subject: Acquisition Reform and Software Metrics, 19 September 1996.
(b) *Practical Software Measurement: A Foundation for Objective Project Management*, Version 3.1a, 17 April 1998.