

# **Acquisition Measurement**

## **A Collaborative Project of PSM**

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***Practical Software and  
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<<We cite the CMMI, SA-CMM, and CMMI-AM. I think we are supposed to put a trademark paragraph in here – I know other organizations do that, e.g., Aerospace – unless there is precedent for PSM not doing it. Let me know and I will dig up a paragraph if needed.>>

## Table of Contents

<b>1</b>	<b>ABOUT THIS PAPER .....</b>	<b>5</b>
1.1	<i>Purpose and Intended Audience .....</i>	5
1.2	<i>Organization .....</i>	5
<b>2</b>	<b>INTRODUCTION TO ACQUISITION MEASUREMENT .....</b>	<b>5</b>
2.1	<i>Acquisition Measurement: Definitions and Scope.....</i>	5
2.1.1	Categories of Acquisition Measurement.....	7
2.1.2	Categories of Supplier Measurement.....	7
2.1.3	Measurement Category Illustration.....	8
2.2	<i>Motivation for Acquisition Measurement .....</i>	9
2.3	<i>Getting Started: Acquisition Measures and the Measurement Process.....</i>	10
<b>3</b>	<b>IDENTIFYING MEASURES FOR THE ACQUISITION PROJECT AND ENTERPRISE .....</b>	<b>10</b>
<b>4</b>	<b>GUIDANCE FOR ESTABLISHING AN EFFECTIVE ACQUISITION MEASUREMENT PROCESS.....</b>	<b>11</b>
4.1	<i>Project Monitoring Measurement (PMM).....</i>	11
4.1.1	PMM: Establish and Sustain Commitment.....	11
4.1.2	PMM: Plan Measurement .....	12
4.1.3	PMM: Perform Measurement .....	13
4.1.4	PMM: Evaluate Measurement .....	14
4.2	<i>Acquisition Project Measurement (APM).....</i>	15
4.2.1	APM: Establish and Sustain Commitment .....	15
4.2.2	APM: Plan Measurement.....	15
4.2.3	APM: Perform Measurement.....	16
4.2.4	APM: Evaluate Measurement.....	17
4.3	<i>Acquisition Enterprise/Organization Measurement (AEOM) .....</i>	17
4.3.1	AEOM: Establish and Sustain Commitment .....	17
4.3.2	AEOM: Plan Measurement.....	18
4.3.3	AEOM: Perform Measurement.....	19
4.3.4	AEOM: Evaluate Measurement.....	20
<b>5</b>	<b>REFERENCES .....</b>	<b>21</b>
<b>6</b>	<b>ACRONYM LIST .....</b>	<b>21</b>
<b>Appendix A: Definitions Relevant to Acquisition and the Acquisition Process</b>		
<b>Appendix B: Strawman Work Breakdown Structure for Acquisition Services</b>		
<b>Appendix C: Acquisition ICM (Information Needs, Measurable Concepts, Measures) Table</b>		
<b>Appendix D: Mapping Section 804, SA-CMM, &amp; CMMI-AM, to Measurement Information Needs</b>		
<b>Appendix E: Sample Acquisition Measure Specifications (for APM and AEOM measures)</b>		

## LIST OF FIGURES

Figure 1. The Practical Software and Systems Measurement (PSM) Process .....	6
Figure 2. Acquirer and Supplier Measurement Categories .....	8
Figure 3. Acquirer and Supplier Measurement Concerns .....	9

## LIST OF TABLES

Table 1. Activities of the Practical Software and Systems Measurement (PSM) Process[6] .....	6
Table 2. Acquisition Measurement Roles .....	11
Table 3. PMM Roles and Responsibilities for Establish and Sustain Commitment .....	11
Table 4. PMM Roles and Responsibilities for Plan Measurement .....	12
Table 5. PMM Roles and Responsibilities for Perform Measurement .....	13
Table 6. PMM Roles and Responsibilities for Evaluate Measurement .....	14
Table 7. APM Roles and Responsibilities for Establish and Sustain Commitment .....	15
Table 8. APM Roles and Responsibilities for Plan Measurement .....	15
Table 9. APM Roles and Responsibilities for Perform Measurement .....	16
Table 10. AEOM Roles and Responsibilities for Establish and Sustain Commitment .....	17
Table 11. AEOM Roles and Responsibilities for Plan Measurement .....	18
Table 12. AEOM Roles and Responsibilities for Perform Measurement .....	19

## 1 ABOUT THIS PAPER

### 1.1 Purpose and Intended Audience

This paper provides a foundation for the discussion and advancement of acquisition measurement, for both government and commercial acquisition organizations. Its primary focus is on improving the way in which acquisition projects and organizations manage and conduct their own activities. A secondary focus is management and oversight of the supplier. As such, the intended audience includes individuals and organizations charged with managing acquisition projects or organizations, performing the day-to-day work of these projects or organizations, and improving acquisition process performance.

The material herein is based on existing guidance developed by the Practical Software and Systems Measurement (PSM) Project for supplier measurement. Information is available at [www.psmc.com](http://www.psmc.com). Readers unfamiliar with PSM are strongly encouraged to download and read Part 1 of the PSM Guidebook, which provides a brief introduction to PSM.

### 1.2 Organization

This paper provides acquisition measurement background and guidance as follows.

Section 2 sets the stage by defining *acquisition measurement* and the context and scope of acquisition covered. Several categories of acquisition and supplier measurement are defined, and their use and relationships discussed.

Once *acquisition measurement* has been defined, the motivation for its use is briefly reviewed. Section 2 concludes by highlighting the importance of establishing an effective, efficient measurement process as well as appropriate measures. These two elements—measures and the measurement process—are addressed in Sections 3 and 4.

Section 3 introduces initial work by the Practical Software and Systems Measurement (PSM) project to identify acquisition information needs and a corresponding set of acquisition measures. Appendix C contains detailed information on these needs and measures. Next, Section 4 describes how the PSM process—initially defined from the supplier perspective—applies to acquisition measurement.

The remaining sections of the paper contain supplementary material. Section 5 identifies resources for additional information and 7 contains an acronym list. Finally, Appendices A-E provide materials to assist readers in identifying information needs and measures relevant to their own acquisition activities.

## 2 INTRODUCTION TO ACQUISITION MEASUREMENT

### 2.1 Acquisition Measurement: Definitions and Scope

This paper uses the following definition of acquisition:<sup>1</sup>

*Acquisition* is the process of acquiring, by agreement (i.e., contract, partnership, or teaming arrangement), products or services to satisfy a specific set of user needs or requirements. The exact set of activities, processes, products and resources involved in an acquisition will depend upon the type of product or service acquired as well as the type of agreement employed in acquisition.

Given the above definition of acquisition, *Acquisition Measurement* may be viewed as the process an acquirer uses to obtain, analyze, and apply quantitative data for effective management and control over the activities, processes, products and resources needed to conduct acquisition. A sound acquisition

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<sup>1</sup> See Appendix A for other definitions.

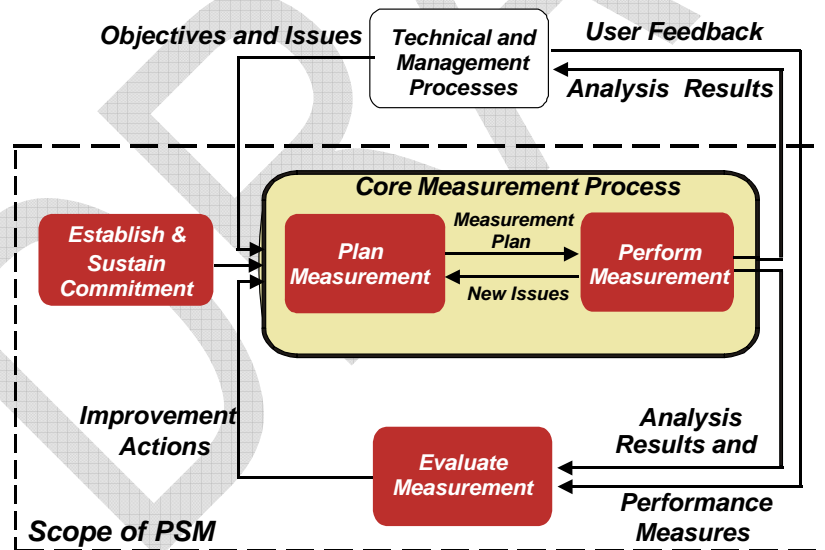
measurement process incorporates the four key measurement activities defined in PSM: Establish and Sustain Commitment; Plan Measurement; Perform Measurement; and Evaluate Measurement. Key steps of these activities are summarized in Table 1.

**Table 1. Activities of the Practical Software and Systems Measurement (PSM) Process [6]**

PSM Activity	Key Activity Steps
Plan Measurement	Identify information needs. Select, prioritize, and specify corresponding measures. Prepare a measurement plan.
Perform Measurement	Collect and validate data. Process and analyze data. Generate reports. Make recommendations that lead to decisions and actions.
Establish and Sustain Commitment	Obtain organizational commitment. Define roles and responsibilities. Provide resources. Review implementation progress.
Evaluate Measurement	Conduct pre-planned, periodic evaluations of the measures and the measurement process against pre-defined criteria.

Figure 1 illustrates the relationships of the PSM activities with one another and with the technical and management processes of a project or organization. The four red boxes represent the four PSM activities. The gold Core Measurement Process box includes *Plan Measurement* and *Perform Measurement*, which comprise the “up and running” measurement process. *Establish and Sustain Commitment* provides resources and motivation for measurement. *Evaluate Measurement* is a pre-planned, objective, periodic activity to determine whether the measures and measurement process are working as intended.

**Figure 1. The Practical Software and Systems Measurement (PSM) Process**



To be effective, acquisition measurement must encompass all factors affecting the acquirer’s ability to meet objectives, both internal factors the acquirer has control over and external factors it may be unable to influence. The latter factors need to be measured and analyzed to enable the acquirer to identify and respond to related risks and problems.

In this paper, the factors of interest for acquisition measurement are grouped into three categories of measurement. These categories are described in the next section, followed by corresponding categories

of supplier measurement. The latter are introduced because of their interfaces with and influence on acquisition measurement.

### 2.1.1 Categories of Acquisition Measurement

Acquisition measurement has three different applications for the acquirer, *Project Monitoring Measurement* (PMM), a joint activity with the supplier; Acquirer Project Measurement (APM); and Acquirer Enterprise/Organization Measurement (AEOM).

Project Monitoring Measurement (PMM) focuses on the acquisition organization's role in obtaining, analyzing and applying supplier data for the purpose of monitoring the progress and quality of the acquisition. This application of measurement is addressed by existing PSM guidance. Acquirers may use PSM's Plan Measurement activity to identify measures and PSM acquisition language to construct the RFP and contract. Suppliers may also use PSM to develop measures and measurement plans. The Acquirer-Supplier measurement definition and analysis activities for project monitoring have proven most effective when performed jointly. Examples of PMM measures include schedule progress for work units and defect density for delivered products.

Acquisition Project Measurement (APM) focuses on selecting, defining, collecting, and analyzing data for the purposes of managing and monitoring the effort, schedule, and quality of the *acquirer's internal* products, processes and resources *applied to a given acquisition project*. APM is also responsible for collecting measures to meet enterprise/organizational information needs, as defined by the Acquisition Enterprise/Organization Measurement program (see below). There is little guidance available for APM. Examples of APM measures include progress measures for capability/CONOPs development, and measures of cycle time and effectiveness for reviewing internal work products (e.g., RFPs) and supplier deliverables (e.g., specifications).

Acquisition Enterprise/Organization Measurement (AEOM)<sup>2</sup> focuses on enterprise- (or organization-) wide information needs. Examples include data reflecting organizational performance across a portfolio of acquisition projects, or data used to analyze needed infrastructure investments. Also, as more acquisition organizations consider improving their own processes, they will need to apply measurement to quantitatively characterize current capability, develop quantitative goals for improvement, and assess progress toward these goals. Examples of AEOM measures include cost, schedule, and defect/failure profiles across projects, and infrastructure performance and usage measures.

While the three categories of measurement identified above focus on the information needs of different levels of an acquisition enterprise, the measurement activities performed will often span levels. For example, if *enterprise* managers determine they need data on the quality of Requests for Proposals (RFPs) released by acquisition *organizations* under their purview, then each *project* will need to plan for, perform, and evaluate measurement accordingly, as part of its APM work. While the information is requested by the enterprise level and may be aggregated at the organization level, APM (project level) will be involved in planning for collection of RFP quality data, performing data analysis, and reporting results as requested by AEOM (enterprise level).

### 2.1.2 Categories of Supplier Measurement

The three categories of Supplier Measurement correspond closely to the three categories of acquisition measurement.

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<sup>2</sup> The distinction between "Enterprise" and "Organization" in this document is simplified as follows: An Organization is taken to be a collection of personnel, processes, and resources that is responsible for managing multiple acquisition projects, perhaps within a larger Enterprise.

Project Monitoring Measurement (PMM), for the supplier, focuses on the supplier's role in obtaining, analyzing and delivering data so that together, the supplier and acquirer can identify and manage risks and problems. This application of measurement is addressed in existing PSM guidance. Examples of PMM measures were supplied in Section 2.1.1.

Supplier Project Measurement (SPM) focuses on measures internal to the supplier that impact project management and performance. Example SPM measures include measures related to financial management such as those pertaining to supplier investments of internal research funding to support project goals.

Supplier Enterprise/Organization Measurement (SEOM) focuses on enterprise- (or organization-) wide information needs. Examples similar to those for AEOM would include defect profiles across projects and infrastructure performance and usage measures. Examples specific to SEOM would include enterprise-wide productivity and profit data.

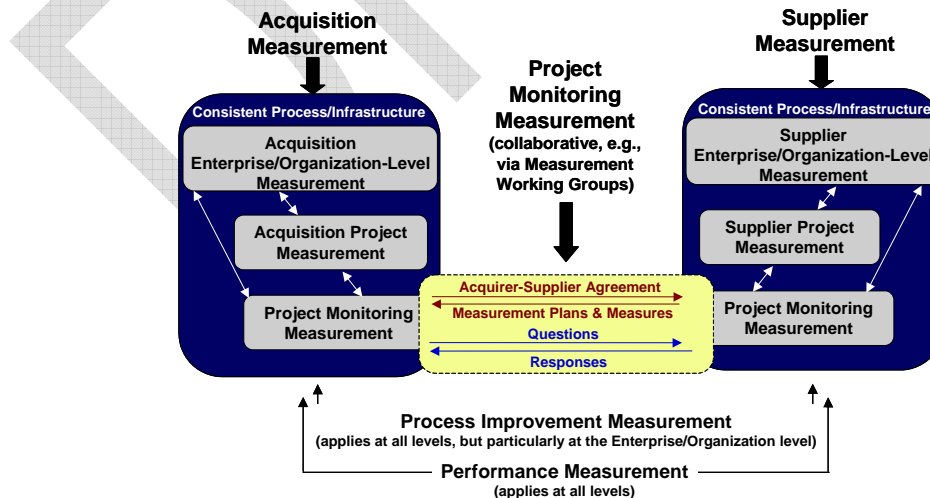
As with acquisition measurement, while the three categories of supplier measurement focus on information needs at different levels of an enterprise, the measurement activities required will usually span levels. For example, if *enterprise* (e.g., corporate business unit) managers determine they need defect density data for delivered products from development *organizations* under their purview, then each *project* in the organization will need to plan for, perform, and evaluate measurement accordingly, as part of its SPM work. While the information is requested by the enterprise level and may be aggregated at the organization level, SPM (project level) will be involved in planning for collection of defect data, performing some data analysis, and reporting the data as requested by SEOM (enterprise level).

### 2.1.3 Measurement Category Illustration

Figure 2 illustrates acquirer and supplier measurement categories. The gray boxes depict a hierarchy of measurement, with AEOM and SEOM at the top, supplying information needs to lower level measurement activities. In turn, the lower level measurement activities supply data and analysis results.

The yellow box shows the working relationship between the acquirer and supplier in the case of project monitoring measurement (PMM).

**Figure 2. Acquirer and Supplier Measurement Categories**

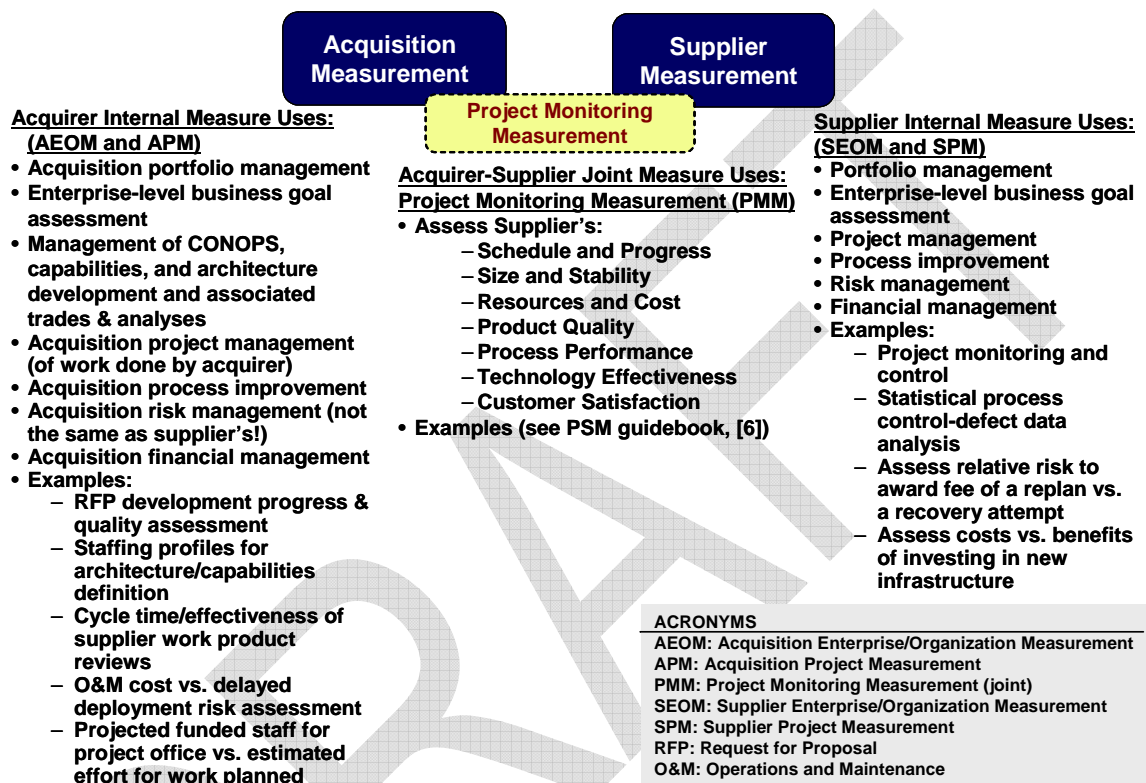




The distinctions between measurement categories can be further examined by considering where Supplier and Acquirer concerns intersect and where they differ.

Figure 3 provides examples.

Figure 3. Acquirer and Supplier Measurement Concerns



## 2.2 Motivation for Acquisition Measurement

While the need for Project Monitoring Measurement is well understood, the motivation for AEOM and APM may need explanation. The value, breadth, and sophistication of supplier measurement in supporting decisions and improving early detection and resolution of problems have increased over time. But a successful acquisition is dependent on the progress and quality of acquirer activities as well. In fact, acquisition products and processes are the foundation on which new capabilities and systems are engineered, built, and deployed. For DoD acquirers, shortcomings in acquisition products and processes have been identified Defense Sciences Board and the US Government Accountability Office studies as fundamental causes of project failure [2,3].

In an acknowledgement of the criticality of the acquisition process to acquisition success, public law 107-314, Section 804 of the Bob Stump National Defense Authorization Act for FY03, requires all military departments and those defense agencies that manage Major Defense Acquisition Programs (MDAPs) with a substantial software component to implement a software acquisition process

improvement program.<sup>3</sup> Measurement is a necessary foundation for process improvement, as it enables improvement goals to be quantified and progress assessed. Without measurement, it is difficult to determine whether practices implemented in the name of improvement are having the intended impact.

Finally, although practices may differ in commercial firms, excelling at supplier management is critical, with goods and services procured contractually for the firm's internal use or as an element of the goods and services the firm itself markets. Measurement can help identify and resolve issues in performing supplier management functions before they negatively impact the quality of a firm's products and services, and in turn, its profitability.

### 2.3 Getting Started: Acquisition Measures and the Measurement Process

Implementing a solid acquisition measurement approach requires a focus in two key areas: identifying the right measures and establishing an effective measurement process. Section 3 describes work in progress to identify a set of candidate measures for APM and AEOM. Section 4 provides guidance, recommendations, and lessons learned for implementing an acquisition measurement process. These sections draw on existing PSM guidance, but focus on characteristics of APM and AEOM that have not previously been addressed in the literature.

## 3 IDENTIFYING MEASURES FOR THE ACQUISITION PROJECT AND ENTERPRISE

In the PSM process, identifying measures begins by studying the information needed by project, organization, or enterprise managers and decision makers.

For APM, we can identify information needs by looking at the acquisition strategy, resources, and constraints and identifying data needed to<sup>4</sup>

- plan, manage, and control the work;
- identify problems and risks early on;
- support decisions vital to project office health;
- respond to questions from the enterprise or organization level; and
- determine whether process improvement actions are having the desired effect.

For AEOM, we can identify information needs by studying the questions Enterprise-level managers need to respond to (whether they come from Congress, the board of directors, or stockholders) that apply across the projects in their portfolios.

At any level, measurement information needs are identified through an iterative process of discussing acquisition problems and risks, proposed process improvements, and quantitative methods for tracking problems, risks, and the impacts of improvement actions. The goal is to make data available for decision making and to select and evaluate process improvement actions.

Appendix C, Acquisition ICM<sup>5</sup> Table, contains a draft table constructed from results of several PSM Acquisition Measurement Working Group sessions conducted from 2004 through 2006. The table identifies sample acquisition management information needs and potential measures. The appendix also describes the intended use of the table in measurement selection, prioritization, and specification.

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<sup>3</sup> While Section 804 is directed toward software acquisition, most – if not all – of its requirements apply equally to systems acquisition.

<sup>4</sup> Appendix B, Strawman Work Breakdown Structure for Acquisition Services, can be used as a guide in identifying the measurable elements of the Acquirer's job.

<sup>5</sup> ICM: Information Need, Measurable Concept, Measure

#### 4 GUIDANCE FOR ESTABLISHING AN EFFECTIVE ACQUISITION MEASUREMENT PROCESS

**Organization of Guidance.** The guidance in this section supplements existing PSM guidance by extending it to acquisition. The three categories of acquisition measurement—PMM, APM and AEOM—are each discussed in terms of the four PSM measurement activities, Establish and Sustain Commitment, Plan Measurement, Perform Measurement, and Evaluate Measurement. The discussions follow a consistent format, with a Context Statement, Roles and Responsibilities table, and list of relevant Lessons Learned for each activity.

**Process and Infrastructure Efficiencies.** While an acquisition organization or enterprise may have many measurement activities and may use different measures for different purposes, use of a consistent measurement process and infrastructure should be encouraged. Training in the process and use of common or interoperable tools will facilitate data sharing, analysis, and understanding.

**Measurement Activity Roles and Responsibilities.** Table 2 identifies key roles for acquisition measurement. For each measurement role, it is necessary to assign responsibilities to individuals with the requisite knowledge and abilities. Responsibilities specific to measurement activities are listed in Table 3 through Table 12.

**Table 2. Acquisition Measurement Roles**

Role Name	Description
Champion	Responsible for promoting the use of measurement and obtaining and allocating necessary funding and resources, and verifying implementation. Also responsible for ensuring the measurement user's information needs are met.
Executive Management	Responsible for identifying enterprise- and organizational-level information needs, supplying resources for enterprise and organizational-level measurement activities, and using data to make decisions impacting the enterprise or organization.
Project Management	Responsible for managing project cost, schedule, quality, performance, and risk. Involved in developing measurement information needs, reviewing measurement plans, and ensuring implementation. Uses measures; evaluates measures and measurement process. Supplies data to enterprise and organizational levels.
Measurement Analyst	Responsible for developing measurement plan, collecting and analyzing data, and reporting results. Also involved in evaluation.
Project Team / Data Providers	Responsible for assisting measurement analyst in identifying and defining measures, reviewing and supplying data, and evaluating the measures and measurement process.

##### 4.1 Project Monitoring Measurement (PMM)

###### 4.1.1 PMM: Establish and Sustain Commitment

###### Context Statement

For PMM, Establish and Sustain Commitment includes obtaining agreement and resources necessary from both Acquirer and Supplier project management to define, implement and sustain the measurement effort needed to address project management information needs.

**Table 3. PMM Roles and Responsibilities for Establish and Sustain Commitment**

PMM Role for <i>Establish and Sustain Commitment</i>	PMM Responsibilities for <i>Establish and Sustain Commitment</i>
Acquirer and Supplier Champions	– Promote sound use of measurement as a key management/decision tool.
Acquirer and Supplier Project Management	– Commit to using measurement data. – Establish a joint acquirer-supplier measurement working group to review and

<b>PMM Role for <i>Establish and Sustain Commitment</i></b>	<b>PMM Responsibilities for <i>Establish and Sustain Commitment</i></b>
	approve measurement plan, processes, and measures. – Review and ensure measurement plan implementation. – Identify and support refinements, as needed.
Supplier Project Management	– Include funding in contract expenses or overhead to support data generation and analysis. – Demonstrate in contractual plans intent to supply resources and follow through in supplying them (e.g., establish roles, responsibilities and resources for data collection, analysis, infrastructure, tools, processes, training, and adaptation of the measures/measurement process).
Acquirer Project Management	– Ensure that the supplier adheres to the responsibilities identified above. – Include funding in project office budget to support data generation and analysis. – Allocate resources to support data generation and analysis (e.g., establish roles, responsibilities and resources for data management, analysis, infrastructure, tools, processes, training, and adaptation of the measures/measurement process).

#### Acquirer Lessons Learned

- Increase likelihood of commitment by educating acquirer and supplier Project Management on the value of, and process for, using quantitative data to support information needs (establishing a joint acquirer-supplier measurement working group can aid this process).
- Ensure contractual plans include adequate resources and funding allocated to measurement.
- Work to establish an acquirer activity to accept, validate and analyze measures.
- Provide training at all levels that emphasizes the need to encourage reporting of accurate data and explains the consequences of penalizing team members for reporting negative information.

#### *4.1.2 PMM: Plan Measurement*

##### Context Statement

For PMM, the foundation for Plan Measurement is a collaborative acquirer-supplier activity to identify information needs, select and define effective and efficient measures to address the needs, and develop and implement a measurement plan that will ensure timely, valid data is available, analyzed and applied by both the supplier and acquirer in managing the project.

**Table 4. PMM Roles and Responsibilities for Plan Measurement**

<b>PMM Role for <i>Plan Measurement</i></b>	<b>PMM Responsibilities for <i>Plan Measurement</i></b>
Acquirer Project Team	– For contractual agreements: <ul style="list-style-type: none"> <li>○ in RFP/contract, specify contractual delivery of project measurement plan and tailorable set of measures, and require proposal to describe both (see PSM Guidebook for sample RFP language).</li> <li>○ Ensure measurement expertise exists on proposal review team.</li> </ul> – For all types of acquirer-supplier agreements, identify quantitative information needed to manage the project and the agreement and discuss with supplier.
Supplier Project Team	– For contractual agreements: <ul style="list-style-type: none"> <li>○ deliver information on proposed measurement plan and measurement set.</li> </ul> – For all types of acquirer-supplier agreements, identify quantitative information needed to manage the project and the agreement and discuss with acquirer.
Acquirer and Supplier Measurement Analysts	– Develop plans for collecting, delivering (supplier or subcontractor)/receiving (acquirer or prime contractor), processing, analyzing, reporting, and using measurement data, and for evaluating the effectiveness of the measures and

PMM Role for <i>Plan Measurement</i>	PMM Responsibilities for <i>Plan Measurement</i>
	measurement process. <ul style="list-style-type: none"> <li>– Identify analysis tools and techniques that need to be procured and that measurement users need training in.</li> <li>– Ensure the evaluation plan includes criteria for evaluating both the measures and the measurement process. Consider evaluations of information needs, priorities, changes due to movement to a new phase, and new measures.</li> </ul>
Acquirer/Supplier Project Management and Champion	<ul style="list-style-type: none"> <li>– Review implementation of measurement plan.</li> </ul>

#### Acquirer Lessons Learned

- Use the joint acquirer/supplier working group established in 4.1.1 to agree on information needs and measures to generate buy-in from both sides. Some of these needs will be joint acquirer-supplier needs and others will be unique to one party. The working group should strive to understand the perspectives and concerns behind the unique needs.
- Establish incentives (e.g., Award Fee) for good measurement practice and for identifying problems and risks early on.
- Identify a balanced set of measures that will supply information related to all project information needs, not just those related to cost and schedule, but also to quality, volatility, performance, and specialty engineering.
- Focus on how measures can be used to provide early warning and insight into risk: in selecting measures, carefully consider how data will be used to address information needs.
- Start with a small set of measures with the ability to grow the set as required.
- Attempt to understand how information needs may change over the acquisition life cycle and ensure sufficient flexibility exists in the agreement to accommodate information needs as they evolve throughout the life cycle.
- Establish decision criteria (e.g., thresholds) that can be used in measurement analysis.
- Ensure that the planned frequency and synchronization of data delivery supports information needs.
- Conduct frequent reviews during the planning process to ensure measurement project stand-up is proceeding effectively.
- Collect only the data necessary and sufficient to satisfy information needs; do not collect data for its own sake. Conversely, ensure the data collected is sufficient to support problem isolation and causal analysis.
- Ensure the plan for measurement program evaluation is defined to be cost effective and efficient, and that the evaluation sessions are scheduled.

#### 4.1.3 PMM: Perform Measurement

##### Context Statement

For PMM, the foundation for Perform Measurement is a set of solid measurement plans, for both the acquirer and supplier. The contract or other agreement should define the supplier's measures and the formats and frequency of delivery. The acquirer's measurement plan should include an approach to storing, validating, and independently analyzing data, and reporting analysis findings to decision makers.

**Table 5. PMM Roles and Responsibilities for Perform Measurement**

PMM Role for <i>Perform Measurement</i>	PMM Responsibilities for <i>Perform Measurement</i>
Acquirer and Supplier Measurement Analyst	<ul style="list-style-type: none"> <li>– Execute a data validation process that is defined in the corresponding (acquirer, supplier) measurement plan.</li> </ul>

<b>PMM Role for <i>Perform Measurement</i></b>	<b>PMM Responsibilities for <i>Perform Measurement</i></b>
	<ul style="list-style-type: none"> <li>– Normalize data; compare with benchmarks, if they exist.</li> <li>– Perform analysis and be prepared to interpret results, comparing to historical data, evaluating against thresholds, and evaluating trends.</li> </ul>
Acquirer and Supplier Project Management and Project Team	<ul style="list-style-type: none"> <li>– Use the data to make decisions.</li> <li>– Reward reporting of honest data.</li> </ul>
Supplier Project Team	<ul style="list-style-type: none"> <li>– Provide the data for supplier analysis and for delivery to acquirer.</li> </ul>
Champion	<ul style="list-style-type: none"> <li>– Review use of measures; show interest in measurement program's success.</li> </ul>

#### Acquirer Lessons Learned

- Discuss analysis results with supplier measurement points of contact prior to presenting to higher level acquisition or supplier management. Provide an opportunity to explain discrepancies, fix data problems, etc., before elevating issues.
- Develop an acquirer measurement analysis capability that goes beyond review of indicator briefing slides (briefing slide review alone does not constitute measurement analysis).
- Use the acquirer measurement plan and acquirer-defined analysis process to conduct independent analysis of low-level data.
- Account for noise in the data -- don't attempt more precise analysis than the data warrants. Focus on ranges of numbers and trends in the data versus single values or data points.

#### *4.1.4 PMM: Evaluate Measurement*

##### Context Statement

For PMM, the Evaluate Measurement activity consists of working sessions that include Acquirer users of measurement data, supplier program management, project team members, and measurement analysts.

**Table 6. PMM Roles and Responsibilities for Evaluate Measurement**

<b>PMM Role for <i>Evaluate Measurement</i></b>	<b>PMM Responsibilities for <i>Evaluate Measurement</i></b>
Acquirer and Supplier Measurement Analysts & Project Management	<ul style="list-style-type: none"> <li>– Define and apply evaluation criteria for both the measures and the measurement process.<sup>6</sup></li> <li>– Ensure Evaluation sessions occur as planned. Hold them jointly where possible (it may be advisable to have acquirer and supplier preparation sessions first).</li> <li>– Ensure all stakeholders in the measurement process (measurement users, measurement champion, data providers) are included in the evaluation process</li> <li>– Ensure that measures and the measurement process are revised per evaluation findings, and that the revisions are reflected in performing measurement.</li> <li>– Review the evaluation process to ensure it is cost effective and efficient..</li> </ul>
Acquirer/Supplier Project Team and Champion	<ul style="list-style-type: none"> <li>– Participate in evaluation process.</li> </ul>

#### Acquirer Lessons Learned

- Invite measurement working group members to participate in the evaluation sessions.
- Schedule the evaluation sessions in advance for greatest participation, and ensure they occur: without them, the usefulness of the measures and the effectiveness of the measurement process are likely to deteriorate.

<sup>6</sup> See the PSM Guidebook [6] section on Evaluate Measurement for sample criteria.



- Use predefined criteria to determine whether measures are delivering the needed information or whether the measures or measurement process should be adjusted. After the criteria-based review, provide an opportunity for round-robin discussion of issues and ideas.

## 4.2 Acquisition Project Measurement (APM)

### 4.2.1 APM: Establish and Sustain Commitment

#### Context Statement

For APM, Establish and Sustain Commitment includes obtaining agreement and resources necessary to define, implement and sustain an effort to measure characteristics of acquisition project office products, processes, and resources. This is key, since even capable suppliers will have difficulty succeeding if work performed by the acquisition project office is deficient.

**Table 7. APM Roles and Responsibilities for Establish and Sustain Commitment**

APM Role for <i>Establish and Sustain Commitment</i>	APM Responsibilities for <i>Establish and Sustain Commitment</i>
Acquirer Champion	– Support implementation of APM.
Executive Management	– Commit to using measurement data. – Provide resources for project-level measurement activities required for organization- or enterprise-wide process improvement.
Acquirer Project Management	– Commit to using measurement data. – Review and approve measurement plan. – Review and ensure measurement plan implementation. – Identify and support refinements, as needed. – Include funding in project office budget to support data generation and analysis. – Allocate resources to support data generation and analysis (e.g., POC for data management, analysis, infrastructure, tools, processes, training, and adaptation of the measures/measurement process).

#### Lessons Learned

- Determine and execute a positive approach to motivate the acquisition project manager to implement and apply a good measurement process.
- Recognize that the acquirer is as responsible as the supplier for using measurement to identify, isolate, and resolve issues that may interfere with project success.
- See also lessons learned from Section 4.1.1, *PMM: Establish and Sustain Commitment*.

### 4.2.2 APM: Plan Measurement

#### Context Statement

For APM, Plan Measurement consists of identifying information needs related to the acquisition project office's role in the acquisition, including its products, resources, and processes. Measures are selected based on these information needs, their relative priorities, and the availability of data. The acquisition project office develops and implements a measurement plan accordingly.

**Table 8. APM Roles and Responsibilities for Plan Measurement**

APM Role for <i>Plan Measurement</i>	APM Responsibilities for <i>Plan Measurement</i>
Acquirer Champion	– Review information needs for adequacy from project, organization, and enterprise perspectives. – Review measurement plan and measures against information needs. – Review implementation of measurement plan.

APM Role for <i>Plan Measurement</i>	APM Responsibilities for <i>Plan Measurement</i>
	<ul style="list-style-type: none"> <li>– Review measurement evaluation plan.</li> </ul>
Acquirer Project Management and Measurement Analyst	<ul style="list-style-type: none"> <li>– Review acquisition activities and products (see Appendix B, Acquisition Work Breakdown Structure) and identify key information needs for each.</li> <li>– Prioritize the information needs and select corresponding measures, considering data availability, effort/cost to collect, and potential value of the data.</li> <li>– Define measures and a PSM-based measurement process, and document in a measurement plan along with roles and responsibilities. Develop plans for collecting, processing, analyzing, reporting, and using measurement data, and for evaluating the effectiveness of the measures and measurement process.</li> <li>– Ensure the evaluation plan includes criteria for evaluating both the measures and the measurement process. Consider evaluations of information needs, priorities, changes due to movement to a new phase, and new measures.</li> <li>– Consider enterprise and organizational information needs and how they might be addressed with the APM measurement set.</li> <li>– Identify data providers and work with them to define a process for providing measures (e.g. template, scripts, process).</li> <li>– Identify analysis tools and techniques that need to be procured and that measurement users need training in.</li> </ul>
Acquirer Project Team	<ul style="list-style-type: none"> <li>– Work with measurement analyst to identify and define measures.</li> </ul>

#### Lessons Learned

- Start small, especially since APM is likely to be new to most acquisition project offices. Start with a set of measures that have the greatest potential value.
- In selecting and defining measures
  - focus on how measures can be used to provide early warning and insight into risk
  - carefully consider how data will be used to address information needs
- Inform the supplier of the APM measurement set, as appropriate (intent is to share information with the supplier, not to obtain approval).
- Conduct frequent reviews during the planning process to ensure measurement program stand-up is proceeding effectively.
- Ensure the plan for measurement program evaluation is defined to be cost effective and efficient, and that the evaluation sessions are scheduled.

#### 4.2.3 *APM: Perform Measurement*

##### Context Statement

For APM, Perform Measurement consists of collecting, normalizing, validating, and analyzing data and providing analysis results and recommendations to the project manager.

**Table 9. APM Roles and Responsibilities for Perform Measurement**

APM Role for <i>Perform Measurement</i>	APM Responsibilities for <i>Perform Measurement</i>
Acquirer Champion	<ul style="list-style-type: none"> <li>– Ensure results are being used. Spearhead necessary adjustments.</li> </ul>
Acquirer Project Management	<ul style="list-style-type: none"> <li>– Review results and determine whether actions are necessary to improve acquisition project office performance (e.g., additional resources in one or more areas of expertise, schedule adjustments, requirements changes, or tool enhancements).</li> <li>– Use data to produce better estimates of workload, improve resource allocation, assess technical work progress and quality (e.g., technical portions of RFP), etc.</li> <li>– Share information with enterprise/organizational level management.</li> </ul>
Acquirer Measurement Analyst	<ul style="list-style-type: none"> <li>– Analyze data and provide to project management.</li> </ul>



APM Role for <i>Perform Measurement</i>	APM Responsibilities for <i>Perform Measurement</i>
Acquirer Project Team	– Supply data and answer questions.

#### Lessons Learned

- Use the data to identify and resolve problems with acquisition products, processes, and resources.
- Adjust the APM measures/measurement process as needed.
- Summarize and share results with organizational and enterprise management, as appropriate (e.g., reveal, don't hide, issues and risks).
- Share results with supplier, especially if doing so will enhance supplier's chances of success (e.g., as appropriate, reveal risks due to acquisition constraints or acquirer-supplied products).
- Capture and store data at the lowest level feasible to enable verification of accuracy and the ability to use the data for problem isolation and historical analysis.
- Maintain data integrity by archiving all raw data, controlling access to data repositories, using tools that prevent entry of invalid data, and ensuring the validity of algorithms used to produce higher level measures and indicators.

#### 4.2.4 APM: Evaluate Measurement

##### Context Statement

For APM, Evaluate Measurement consists of reviewing measures and the measurement process to determine whether they are accurate, useful, and provide information needed to improve project office performance.

##### Roles and Responsibilities

Roles and responsibilities are similar to those for the Evaluate Measurement activity in PMM (Section 4.1.4).

##### Lessons Learned

See Lessons Learned for the Evaluate Measurement activity in PMM (Section 4.1.4).

#### 4.3 Acquisition Enterprise/Organization Measurement (AEOM)

##### 4.3.1 AEOM: Establish and Sustain Commitment

##### Context Statement

For AEOM, Establish and Sustain Commitment includes clearly identifying the champion for the measurement activity, the information needs, and the source and amount of resources to be applied for measurement. The champion also needs to be clear about the intended use of the data and how the data will be protected from disclosure and improper use.

**Table 10. AEOM Roles and Responsibilities for Establish and Sustain Commitment**

AEOM Role for <i>Establish and Sustain Commitment</i>	AEOM Responsibilities for <i>Establish and Sustain Commitment</i>
Acquirer Champion	<ul style="list-style-type: none"> <li>– Obtain support for implementation of AEOM.</li> <li>– Identify information needs.</li> <li>– Identify allowable and prohibited uses of measurement data.</li> <li>– Identify resources and funding to be applied toward enterprise measurement, <i>at both the enterprise and project level</i>.</li> <li>– Ensure data source protection.</li> <li>– Supply initial parameters and assumptions of measurement program to project/organization managers and others who will need to provide data. Look at existing measurement processes to estimate required resources and personnel</li> </ul>

AEOM Role for <i>Establish and Sustain Commitment</i>	AEOM Responsibilities for <i>Establish and Sustain Commitment</i>
	qualifications.
Acquirer Project and Executive (Organizational/Enterprise) Management	<ul style="list-style-type: none"> <li>– Review initial parameters of measurement program and provide feedback to sponsor.</li> <li>– Commit to using measurement data.</li> </ul>
Acquirer Project Management	<ul style="list-style-type: none"> <li>– Identify funding requirements to support data generation and analysis.</li> <li>– Allocate resources to support data generation and analysis (e.g., point of contact for data management, analysis, infrastructure, tools, processes, training, and adaptation of the measures/measurement process).</li> </ul>
Executive Management	<ul style="list-style-type: none"> <li>– Provide funding.</li> </ul>

### Lessons Learned

- Take precautions to ensure data will not be used to punish poor performance; otherwise, the manager will not get the valid, accurate data needed to manage the enterprise.
- Try to ensure long-term commitment to the measurement program, especially when the champion moves on.
- Plan and execute activities to continuously improve the measurement program (if this isn't done, the measurement set will likely stagnate rather than evolve to meet emerging information needs)
- Re-establish commitment to measurement, with a focus on information needed to sustain and enhance enterprise/organizational performance.

### 4.3.2 AEOM: Plan Measurement

#### Context Statement

For AEOM, Plan Measurement consists of identifying information needs related to the organization's or enterprise's goals, objectives, and reporting requirements; selecting, defining, and prioritizing measures to address these needs; communicating the measures and information needs to project managers and other parts of the enterprise from which data are to be obtained; documenting agreements, policies, or directives related to data delivery and usage; and documenting an enterprise measurement plan for conducting the enterprise-wide measurement process.

**Table 11. AEOM Roles and Responsibilities for Plan Measurement**

AEOM Role for <i>Plan Measurement</i>	AEOM Responsibilities for <i>Plan Measurement</i>
Acquirer Champion and Enterprise Measurement Analyst	<ul style="list-style-type: none"> <li>– Use goals, objectives, and reporting requirements to identify information needs.</li> <li>– Identify and document policies, directives, and instructions related to enterprise-level measurement.</li> <li>– Identify existing measures or known data items and indicators (e.g., those already in use by projects/organizations).</li> <li>– Identify data/measure aggregation constructs.</li> <li>– Provide information needs, measures, data items, indicators, and aggregation structures to project managers or organizations responsible for supplying data.</li> </ul>
Enterprise Measurement Analyst	<ul style="list-style-type: none"> <li>– Once an initial measurement set has been defined, develop a PSM-based measurement process, document the process in a measurement plan along with roles and responsibilities, and provide the plan to project/organization managers for review. Include plans for collecting, processing, analyzing, reporting, and using measurement data, and for evaluating the effectiveness of the measures and measurement process.</li> <li>– Ensure the evaluation plan includes criteria for evaluating both the measures and the measurement process. Consider evaluations of information needs, priorities, and new measures.</li> </ul>

AEOM Role for <i>Plan Measurement</i>	AEOM Responsibilities for <i>Plan Measurement</i>
	<ul style="list-style-type: none"> <li>– Define approach to maintain data integrity - save enough contextual information to be able to interpret data correctly.</li> <li>– Identify analysis tools and techniques that need to be procured and in which measurement users need to be trained.</li> <li>– Enable projects to compare themselves with organizational norms in order to focus improvement efforts.</li> </ul>
Acquirer Project and Organization Management	<ul style="list-style-type: none"> <li>– Review enterprise information needs and measures and incorporate into project-level measurement activities and measurement plans (APM and/or PMM) OR suggest alternatives, if appropriate.</li> <li>– Identify issues with proposed enterprise measurement activities.</li> <li>– Review and make recommendations on enterprise measurement plan.</li> <li>– Decide on appropriate levels of data reporting/aggregation.</li> </ul>
Acquirer Project Team	<ul style="list-style-type: none"> <li>– Work with measurement analyst to identify and define measures.</li> </ul>

#### Lessons Learned

- Start small, especially since AEOM is likely to be new to most acquisition organizations and project offices. Start with a set of measures that have the greatest potential value.
- Conduct frequent reviews during the planning process to ensure measurement project stand-up is proceeding effectively.
- Ensure the plan for measurement program evaluation is defined to be cost effective and efficient, and that the evaluation sessions are scheduled.
- Involve project / organization managers who will need to supply data.
  - Consider existing measures from APM and PMM.
  - Standardize where possible (perhaps on Information Needs, if not measures).
  - Define comprehensive measurement specifications to enable roll-up/aggregation across organizations/enterprise.
- Ensure the measurement process is designed to respond to evolving information needs.
- Allow drill down (to find common root causes), as well as aggregation (to represent organizational performance).
- Include project managers in the process for defining information needs.
- Allow tailoring at the project level.

#### 4.3.3 AEOM: Perform Measurement

##### Context Statement

For AEOM, Perform Measurement consists of collecting, normalizing, validating, and analyzing data and asking questions/making enterprise-wide decisions based on the data collected.

**Table 12. AEOM Roles and Responsibilities for Perform Measurement**

AEOM Role for <i>Perform Measurement</i>	AEOM Responsibilities for <i>Perform Measurement</i>
Enterprise Measurement Analyst	<ul style="list-style-type: none"> <li>– Analyze data and provide report to executive manager/champion.</li> </ul>
Acquirer Project and Organization Management	<ul style="list-style-type: none"> <li>– Provide requested data to organization/enterprise (usually delegated to project measurement analyst - usually aggregated from project level data).</li> <li>– Respond to questions/requests for further analysis.</li> </ul>
Executive Managers and Other Measurement Users	<ul style="list-style-type: none"> <li>– Review report and recommendations; make decisions based on the data.</li> </ul>

Lessons Learned

- Use the data; ask follow-up questions.
- Capture and store data at the lowest level feasible to enable verification of accuracy and the ability to use the data for problem isolation and historical analysis.
- Maintain data integrity by archiving all raw data, controlling access to data repositories, using tools that prevent entry of invalid data, and ensuring the validity of algorithms used to produce higher level measures and indicators.
- Do not penalize the project or organization for reporting honest data, even if negative
  - If honest data reporting is penalized rather than valued, the data needed to manage, control, and improve will not be available.
- Do not “mandate” numeric goals for improvement. Such goals may be helpful, but making them mandatory is often counterproductive:
  - If improvement by x% is mandated, improvement by x% will likely be shown whether or not the improvement has been realized.
- Share enterprise-wide results (but not sources) with project / organization managers.

*4.3.4 AEOM: Evaluate Measurement*Context Statement

For AEOM, Evaluate Measurement consists of reviewing measures and the measurement process to determine whether they are accurate, useful, and provide information needed to improve project office performance of its role in the acquisition.

Roles and Responsibilities

Roles and responsibilities are similar to those for the Evaluate Measurement activity in PMM (Section 4.1.4).

Lessons Learned

See Lessons Learned for the Evaluate Measurement activity in PMM (Section 4.1.4).

## 5 REFERENCES

- [1] Army Software Metrics Office web site, <http://www.armysoftwaremetrics.org/index.asp>
- [2] Defense Science Board (DSB). 2000. Report of the Defense Science Board Task force on Defense Software.
- [3] Government Accountability Office (GAO). 2004. *DEFENSE ACQUISITIONS: Stronger Management Practices Are Needed to Improve DoD's Software-Intensive Weapon Acquisitions*, GAO Report GAO-04-393.
- [4] ISO/IEC 15939. 2002. **Information Technology – Software Measurement Process**, El Emam, K. and D. Card., International Organization for Standardization.
- [5] McGarry, J., Card, D., Jones, C., Layman, B., Clark, E., Dean, J., and F. Hall. 2001. **Practical Software Measurement: Objective Information for Decision Makers**, Addison-Wesley.
- [6] US Army and DoD. 2003. **Practical Software and System Measurement, Version 4.0b/c**, Practical Software and System Measurement Project, [www.psmc.com](http://www.psmc.com)

## 6 ACRONYM LIST

AEOM	Acquisition Enterprise/Organization Measurement
APM	Acquisition Project Measurement
CMMI	Capability Maturity Model Integration
CMMI-AM	Capability Maturity Model Integration – Acquisition Module
CMMI-SE/SW/IPPD/SS	Capability Maturity Model Integration for Systems Engineering, Software Engineering, Integrated Product and Process Development and Supplier Sourcing
CONOPS	Concept of Operations
FY	Fiscal Year
ICM	<u>I</u> nformation Needs-Measurable <u>C</u> oncepts- <u>M</u> easures (formerly in PSM, <u>I</u> ssue- <u>C</u> ategory- <u>M</u> easure)
MDAPs	Major Defense Acquisition Programs
O&M	Operations and Maintenance
PMM	Project Monitoring Measurement
PSM	Practical Software and System Metrics
RFP	Request for Proposal
SA-CMM	Software Acquisition Capability Maturity Model
SEOM	Supplier Enterprise/Organization Measurement
SPM	Supplier Project Measurement
TWG	Technical Working Group
WBS	Work Breakdown Structure

**APPENDIX A: DEFINITIONS RELEVANT TO ACQUISITION AND THE ACQUISITION PROCESS**

The members of the Acquisition Measurement working group represented a variety of organizations that acquire products and services, including development contractors, Department of Defense organizations, intelligence and civil agencies, commercial industry, Federally Funded Research and Development Centers, and System Engineering and Technical Assistance organizations. The group discovered a number of differences in the definitions of terms used to discuss acquisition measurement, differences reflecting the various acquirers' regulatory environments, acquisition instruments, and organizational structures.

For each key term listed in the table below, this appendix lists all definitions the group reviewed along with their sources. Where more than one definition is included, the definition used in this paper appears first and is indicated by \*.

Key Term	Source(s) for Definitions
Acquirer	ISO 15288
Acquisition	This Paper ( <i>The definition of Acquisition used in this paper was derived from the definitions contained in the references listed below.</i> ) Defense Acquisition University (DAU) Federal Acquisition Regulation (FAR) Software Acquisition Capability Maturity Model (SA-CMM) Capability Maturity Model Integration for Systems Engineering, Software Engineering, Integrated Product and Process Development and Supplier Sourcing (CMMI-SE/SW/PPD/SS, or CMMI)
Acquisition Enterprise	This paper
Acquisition Organization	SA-CMM
Acquisition Planning	FAR
Acquisition Process	SA-CMM
Acquisition Project	SA-CMM
Acquisition Strategy	CMMI
Enterprise	CMMI and ISO 15288
Organization	CMMI and ISO 15288
Organizational Unit	CMMI
Project	ISO 15288, CMMI and SA-CMM
Project Manager	CMMI and SA-CMM
Project Office	SA-CMM
Program	CMMI
Supplier	ISO 15288, CMMI and SA-CMM
<b>Relationships between the Terms Project, Organization, Enterprise, and Program (as used in this paper)</b>	
<p>A project is an endeavor with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements. In this paper, "program" is synonymous with "project."</p> <p>An organization is an administrative structure in which people collectively manage <i>one or more projects</i> as a whole, and whose projects share a senior manager and operate under the same policies.</p> <p>An Enterprise may consist of <i>many organizations</i> and may have unifying, overarching policies with which all constituent organizations and projects must comply.</p> <p>See also the definitions below for each of these terms.</p>	



**Definitions of Terms** [check hyperlinks prior to release]

**Acquirer** The stakeholder that acquires or procures a product or service from a supplier. [Source: ISO/IEC 15288:2002(E), Systems Engineering – System life cycle processes]

**\*Acquisition** The process of acquiring, by agreement (i.e., contract, partnership, or teaming arrangement), products or services to satisfy a specific set of user needs or requirements. The exact set of activities, processes, products and resources involved in an acquisition will depend upon the type of product or service acquired and the type of agreement employed in the acquisition. [Source: This paper.]

**Acquisition** The conceptualization, initiation, design, development, test, contracting, production, deployment, support, modification, and disposal of systems, supplies, or services to satisfy a specific set of user needs or capability requirements. [Source: paraphrased from DAU on-line glossary, version 11, <http://akss.dau.mil/jsp/Glossary.jsp>]

**Acquisition** The acquiring by contract with appropriated funds of supplies or services (including construction) by and for the use of the Federal Government through purchase or lease, whether the supplies or services are already in existence or must be created, developed, demonstrated, and evaluated. Acquisition begins at the point when agency needs are established and includes the description of requirements to satisfy agency needs, solicitation and selection of sources, award of contracts, contract financing, contract performance, contract administration, and those technical and management functions directly related to the process of fulfilling agency needs by contract. [Source: FAR Volume 1, Part 2, Definitions of Words and Terms, Subpart 2.1, Definitions, Issued September 2001 by the GSA, DoD, and NASA, <http://www.arnet.gov/far/loadmainre.html>]

**Acquisition** The process of obtaining through contract. [Source: SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

**Acquisition** The process of obtaining through contract, any discrete action or proposed action by the acquisition entity that would commit to invest (appropriated funds) for obtaining products and services. [Source: CMMI-SE/SW/PPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>; also, Adapting CMMI for Acquisition Organizations: A Preliminary Report, forthcoming]

**Acquisition Enterprise** A collection of acquisition organizations reporting to the same acquisition authority. Enterprises may be composed of other enterprises. [Source: this paper]

**\*Acquisition Organization** That entity which has the oversight responsibility for the acquisition project and which may have purview over the acquisition activities of a number of projects or contract actions. [Source: SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

**Acquisition Planning** The process by which the efforts of all personnel responsible for an acquisition are coordinated and integrated through a comprehensive plan for fulfilling the agency need in a timely manner and at a reasonable cost. It includes developing the overall strategy for managing the acquisition. [Source: FAR Volume 1, Part 2, Definitions of Words and Terms, Subpart 2.1, Definitions, Issued September 2001 by the GSA, DoD, and NASA, <http://www.arnet.gov/far/loadmainre.html>]

**Acquisition Process** A set of activities used to acquire products. There are two aspects to the Acquisition Process: (1) the acquisition organization's standard acquisition process – the acquisition organization's fundamental acquisition process which guides the establishment of each project's defined acquisition process, and (2) the project's defined acquisition process – the project's tailored version of (1). [Source: Paraphrased from SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

**\*Acquisition Project** A managed set of interrelated resources that acquires one or more products for a customer or end user. This set of resources has a definite beginning and end and typically operates according to a plan. Such a plan is frequently documented and specifies the product to be delivered or implemented, the resources and funds used, the work to be done, and a schedule for doing the work. [Source: Paraphrased from the definition for Project in CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**Acquisition Project** An undertaking that is focused on acquiring products. [Source: SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

**Acquisition Strategy** The specific approach to acquiring products and services that is based on considerations of supply sources, acquisition methods, requirements specification types, contract or agreement types, and the related acquisition risk. [Source: CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**\*Enterprise** When CMMI models refer to an “enterprise,” they illustrate the larger entity not always reached by the word “organization.” Companies may consist of many organizations in many different locations with different customers. The word “enterprise” refers to the full composition of companies. For purposes of this paper, see **Acquisition Enterprise**. [Source: CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**Enterprise** That part of an organization with responsibility to acquire and to supply products and/or services according to agreements. Note that an organization may be involved in several enterprises and an enterprise may involve one or more organizations. For purposes of this paper, see **Acquisition Enterprise**. [Source: ISO/IEC 15288:2002(E), Systems Engineering – System life cycle processes]

**\*Organization** An administrative structure in which people collectively manage one or more projects as a whole, and whose projects share a senior manager and operate under the same policies. However, the word “organization” as used throughout CMMI models can apply to one person who performs a function in a small organization that might be performed by a group of people in a large organization. For purposes of this paper, see **Acquisition Organization**. Source: CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**Organization** A group of people and facilities with an arrangement of responsibilities, authorities and relationships. [Source: ISO/IEC 15288:2002(E), Systems Engineering – System life cycle processes]



**Organizational Unit** A portion of an organizational unit that deploys one or more processes that have a coherent process context and operates within a coherent set of business objectives. An organizational unit is typically part of a larger organization, although in a small organization, the organizational unit may be the whole organization. [Source: Paraphrased from CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**Program** \*(1) A project. (2) A collection of related projects and the infrastructure that supports them, including objectives, methods, activities, plans, and success measures. See also CMMI definition for “project.” Note that this paper uses definition (1). [Source: CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**\*Project** An endeavor with defined start and finish dates undertaken to create a product or service in accordance with specified resources and requirements. [Source: ISO/IEC 15288:2002(E), Systems Engineering – System life cycle processes]

**Project** In CMMI models, a “project” is a managed set of interrelated resources that delivers one or more products to a customer or end user. This set of resources has a definite beginning and end and typically operates according to a plan. Such a plan is frequently documented and specifies the product to be delivered or implemented, the resources and funds used, the work to be done, and a schedule for doing the work. A project can be composed of projects. [Source: CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**Project** An undertaking that is focused on acquiring or developing a specific product or products. Typically, a project has its own funding, cost accounting, and delivery schedule. [Source: SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

**\*Project Manager** The role with total business responsibility for the entire project; the individual who directs, controls, administers and regulates a project. [Source: SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

**Project Manager** The person responsible for planning, directing, controlling, structuring, and motivating the project. [Source: CMMI-SE/SW/IPPD/SS, Version 1.1, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/cmmi/models/models.html>]

**Project Office** The aggregate of individuals assigned responsibility for acquisition in the contracted effort. A project office may vary in size from a single individual assigned part time to a large organization assigned full time. [Source: SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

**\*Supplier** An organization or an individual that enters into an agreement with the acquirer for the supply of a product or service, even if that entity is part of the acquiring organization. [Source: Paraphrased from ISO/IEC 15288:2002(E), Systems Engineering – System life cycle processes]

**Supplier** (1) An entity delivering products or performing services being acquired. (2) An individual, partnership, company, corporation, association, or other service having an agreement (contract) with an acquirer for the design, development, manufacture, maintenance, modification, or supply of items under the terms of an agreement (contract). [Source: CMMI-SE/SW/IPPD/SS, Version

1.1, Software Engineering Institute, March 2002,  
<http://www.sei.cmu.edu/cmmi/models/models.html>]

**Supplier** The entity delivering the product being acquired by contract, even if that entity is part of the acquiring organization. [Source: SA-CMM, Version 1.03, Software Engineering Institute, March 2002, <http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html>]

DRAFT

**APPENDIX B: STRAWMAN WORK BREAKDOWN STRUCTURE FOR ACQUISITION SERVICES**

This is the top-level work breakdown structure (WBS) for acquisition developed by the Acquisition Measurement working group. **[Add the complete table when done, or not needed?]**

WBS #			Title
1.0			Acquisition Project or Program
1.1			Acquisition Management
	1.1.1		Strategic Planning for Acquisition
		1.1.1.1	Studies and Analyses
	1.1.2		Detailed Acquisition Planning
	1.1.3		Solicitation and Source Selection
	1.1.4		Acquisition Execution and Control
		1.1.4.1	Supplier Performance Management
		1.1.4.2	Supplier Product Evaluation/Review
		1.1.4.3	Supplier Process Evaluation/Review
	1.1.5		Transition to Operations and Support
		1.1.5.1	Distribution Management
		1.1.5.2	Implementation
		1.1.5.3	Project Closeout or Iteration Assessment
1.2			Acquisition Support
	1.2.1		Configuration Management
	1.2.2		Product and Process QA
	1.2.3		Measurement and Analysis
	1.2.4		Decision Analysis and Resolution
	1.2.5		Acquisition Product Review
	1.2.6		Training
	1.2.7		Program Environment
	1.2.8		Unique Program Requirements
	1.2.9		Financial Management
	1.2.10		Contract Management
1.3			Acquisition Risk Management
	1.3.1		Risk Management Planning
	1.3.2		Risk Management
		1.3.2.1	Monitoring
		1.3.2.2	Mitigation
		1.3.2.3	Retirement
		1.3.2.4	Proactive Risk Identification
1.4			Requirements Development and Management
	1.4.1		Requirements Development and Management Planning
	1.4.2		Requirements Elicitation and Documentation
	1.4.3		Supplier Requirements Traceability Monitoring
	1.4.4		Requirements Management
1.5			Verification and Validation
	1.5.1		Verification and Validation Planning
	1.5.2		Verification
	1.5.3		Validation
1.6			Integrated Team Management
	1.6.1		Team / Team Member Identification
	1.6.2		Team Structure and Decision-Making Authority Definition
1.7			Process Management
	1.7.1		Acquisition Process Identification, Tailoring and Development
	1.7.2		Process Effectiveness Assessment
	1.7.3		Process Change Management
1.8			Other Duties as Assigned

**APPENDIX C: ACQUISITION ICM (Information Needs, Measurable Concepts, Measures) TABLE**

***In progress***

***[Reminder: In this section, before the table, include front matter that defines the measurement categories as well as the terms program, project, enterprise and organization. Refer to the table at the beginning of Appendix A for definitions of the terms program, project, enterprise, and organization.]***

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**APPENDIX D: MAPPING SECTION 804, SA-CMM, & CMMI-AM, TO MEASUREMENT INFORMATION NEEDS (DRAFT)**

This appendix maps from Section 804 processes and institutionalization goals to the Software Acquisition CMM, CMMI Acquisition Module, [we may want to change this to refer to the forthcoming Adapting CMMI for Acquisition Organizations preliminary report] and associated information needs. This is a draft; hence, some of the process area mappings may be in error. Also, need to complete the Measurement Information Needs column.

The purpose of the table is to provide a tool for selecting measures to support implementation of Section 804.

Section 804 Institutionalization and Acquisition Process Areas (PAs)	Software Acquisition-CMM (SA-CMM) Institutionalization Features and Key PAs (KPAs) with Maturity Level (ML)	CMMI Acquisition Module (CMMI-AM) PAs & Generic Practices (GPs)	Measurement Information Needs
<b>For the acquisition process improvement program as a whole, establish and sustain:</b> <ul style="list-style-type: none"> <li>Goals, milestones and measures associated with planned process improvements</li> <li>Resources to be applied, including mechanisms for ensuring appropriate training and experience for key personnel</li> <li>Approach and evaluation criteria for guiding and assessing process improvement activities and goals</li> <li>Measures for performance measurement and continuous process improvement</li> <li>Mechanisms for ensuring adherence to the established program</li> </ul>	<b>KPAs (ML):</b> <ul style="list-style-type: none"> <li>Process Definition and Maintenance (3)</li> <li>Quantitative Process Management (4)</li> <li>Acquisition Innovation Management (5)</li> <li>Continuous Process Improvement (5)</li> </ul>	<b>PAs:</b> <ul style="list-style-type: none"> <li>2.5 Measurement and Analysis</li> <li>2.7 Product and Process Quality Assurance</li> </ul>	
<b>For each 804 Process Area, establish and sustain:</b> <ul style="list-style-type: none"> <li>Organizational commitment/ resources/ responsibilities <ul style="list-style-type: none"> <li>Policy &amp; plan</li> <li>Resources, responsibility and authority for</li> </ul> </li> </ul>	<b>SA-CMM Process (IFs) (for each SA-CMM KPA, establish and sustain:)</b> <ul style="list-style-type: none"> <li>Commitment to Perform</li> <li>Ability to Perform</li> <li>Measurement and</li> </ul>	<b>CMMI Acquisition Module GPs (for each CMMI-AM PA, establish and sustain):</b> <ol style="list-style-type: none"> <li>Establish and maintain organizational policy</li> <li>Establish and Maintain plan for performing the process</li> <li>Provide adequate resources for performing the process, developing the work products,</li> </ol>	

Section 804 Institutionalization and Acquisition Process Areas (PAs)	Software Acquisition-CMM (SA-CMM) Institutionalization Features and Key PAs (KPAs) with Maturity Level (ML)	CMMI Acquisition Module (CMMI-AM) PAs & Generic Practices (GPs)	Measurement Information Needs
<p>performing process and developing work products/providing services</p> <ul style="list-style-type: none"> <li>– Training</li> <li>• Management of acquisition processes and work products               <ul style="list-style-type: none"> <li>– Documented/updated process</li> <li>– Work products under CM and reviewed for quality</li> </ul> </li> <li>• Monitoring and improvement activities to better achieve the purpose of the process, aligned with supporting the acquisition requirements               <ul style="list-style-type: none"> <li>– Process monitored and controlled against plan and appropriate corrective action taken</li> <li>– Process performance objectively evaluated against description/procedures and non-compliance addressed</li> <li>– Information from planning and performing is collected from work products, measures, and improvement efforts to support use and improvement of organizational processes and process assets</li> <li>– Relevant stakeholders are involved, as planned, and activities, status and results of process are reviewed with higher level management and issues are resolved</li> </ul> </li> </ul>	<p>Analysis</p> <ul style="list-style-type: none"> <li>• Verifying Implementation</li> </ul> <p>SA-CMM PA:</p> <ul style="list-style-type: none"> <li>• Training Program (3)</li> <li>• Others</li> </ul>	<p>and providing the services of the process</p> <ol style="list-style-type: none"> <li>4. Assign responsibility and authority for performing the process, developing the work products, and providing the services of the process</li> <li>5. Train the people performing or supporting the process as needed</li> <li>6. Place designated work products of the process under appropriate levels of CM</li> <li>7. Identify and involve relevant stakeholders as planned</li> <li>8. Monitor and control the process against the plan for performing the process and take corrective action</li> <li>9. Objectively evaluate adherence of the process against its process description, standards and procedures and address noncompliance</li> <li>10. Review the activities, status and results of the process with higher level management and resolve issues</li> <li>11. Establish and maintain the description of a defined process</li> <li>12. Collect work products, measures, measurement results and improvement information derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets</li> </ol> <p><b>CMMI-AM PA:</b></p> <ul style="list-style-type: none"> <li>• 2.6 Organizational Environment for Integration</li> <li>• Others</li> </ul>	

Section 804 Institutionalization and Acquisition Process Areas (PAs)	Software Acquisition-CMM (SA-CMM) Institutionalization Features and Key PAs (KPAs) with Maturity Level (ML)	CMMI Acquisition Module (CMMI-AM) PAs & Generic Practices (GPs)	Measurement Information Needs
Acquisition Planning (must support evolutionary & spiral development)	<ul style="list-style-type: none"> <li>Software Acquisition Planning (2)</li> </ul>	2.9 Project Planning	
Requirements Development and Management	<ul style="list-style-type: none"> <li>Requirements Development and Management (2)</li> <li>User Requirements (3)</li> </ul>	2.10 Requirements Development 2.11 Requirements Management	
Configuration Management	--	2.1 Configuration Management	
Risk Management	<ul style="list-style-type: none"> <li>Acquisition Risk Management (3)</li> </ul>	2.12 Risk Management	
Project Management & Oversight	<ul style="list-style-type: none"> <li>Project Management (2)</li> <li>Contract Tracking and Oversight (2)</li> <li>Contract Performance Management (3)</li> <li>Project Performance Management (3)</li> <li>Quantitative Acquisition Management (4)</li> </ul>	2.3 Integrated Project Management 2.8 Project Monitoring and Control	
Test and Evaluation	<ul style="list-style-type: none"> <li>Evaluation (2)</li> </ul>	2.15 Validation 2.16 Verification	
Integrated Team Management	--	2.4 Integrated Teaming	
Solicitation and Source Selection (including criteria for evaluating past performance, process maturity and product maturity)	<ul style="list-style-type: none"> <li>Solicitation (2)</li> </ul>	2.2 Decision Analysis and Resolution 2.13 Solicitation and Contract Monitoring	
--	<ul style="list-style-type: none"> <li>Transition to Support (2)</li> </ul>	2.14 Transition to Operations and Support	

**APPENDIX E: SAMPLE ACQUISITION MEASURE SPECIFICATIONS (FOR APM AND AEOM MEASURES)**

**To be developed**

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