



Carnegie-Mellon University
Software Engineering Institute

Special Report
CMU/SEI-96-SR-004

Software Acquisition
Capability Maturity Model SM
Pilot Appraisal Report, Version 1.0

Jack R. Ferguson
Lawrence G. Jones
Jan Philpot

November 1996

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Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

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Software Acquisition Capability Maturity ModelSM Pilot Appraisal Report, Version 1.0

Abstract: This document summarizes five pilot appraisals performed from the third quarter of 1995 through the first quarter of 1996 using the *Software Acquisition Capability Maturity Model* (SA-CMM). The pilot appraisals used Version 0.01 of the SA-CMM, published in June 1995; Version 0.02 of the SA-CMM, published in February 1996; and the CMM-based appraisal methodology for internal process improvement (CBA IPI), tailored for use with the SA-CMM.

Introduction

Objectives

This document summarizes five pilot appraisals performed from the third quarter of 1995 through the first quarter of 1996 using the *Software Acquisition Capability Maturity Model* (SA-CMM). The pilot appraisals used Version 0.01 of the SA-CMM, published in June 1995; Version 0.02 of the SA-CMM, published in February 1996; and the CMM-based appraisal methodology for internal process improvement (CBA IPI), tailored for use with the SA-CMM.

The objective of the pilot appraisals is to gather data on the validity of the model and the appraisal method when they are applied to a variety of organizations. The SA-CMM author team gathered, captured, and used data from the pilot appraisals to modify subsequent draft versions of the model.

While the CBA IPI methodology can be used to provide ratings [maturity level and key process area (KPA) goal satisfaction], the SA-CMM pilot appraisal findings included only strengths and opportunities for improvement relative to practices in the model.

Each appraisal team included two or more SA-CMM authors, one CBA IPI lead assessor, one Software Engineering Institute (SEI) facilitator, and three or more site team members.

Organizations appraised

Five separate appraisals were performed for the organizations listed below between October 1995 and March 1996.

- Air Force Missile Warning and Space Surveillance Sensors
- Air Force Mission Planning Systems Program Office
- Navy Cruise Missile Weapon Systems Program Office
- Army Research, Development, and Engineering Center (ARDEC) Fire Control and Software Engineering Division
- Defense Information Systems Agency (DISA) Applications Engineering Facility

**Appraisal
schedule**

Pilot appraisals were conducted over two weeks:

- Training (four days) - SA-CMM (one day), CBA IPI (two days), in-briefing and maturity questionnaire (one day)
 - Assessment (five days) - Interviews and data gathering (three days), draft findings preparation and briefing (one day), final findings preparation and briefing (one day)
-

**Appraisal
characteristics**

The organizations appraised were selected to participate due to the differences in service, mission (life-cycle phase), and domain. Table 1-1 summarizes some of the characteristics of the appraisals and of the organizations. Table 1-1 also lists the members of the appraisal teams.

Organization	Mission	Domain	Appraisal Team
Air Force Missile Warning and Space Surveillance Sensors	Post-deployment software support (PDSS) of missile and space sensor systems five projects	Radar and optical sensor control systems	• CBA lead: Larry Jones • Authors: Jack Cooper, Jack Ferguson • Facilitators: Mike Ginn, Jan Philpot • Site: Bill Bahl, Pam Conner, Gail Steele
Air Force Mission Planning Systems Program Office	Development of mission planning systems for aircraft/electronics/weapons combat operations six integrated product teams	Command and control systems; multiple systems integrator, route planning and critical data generator integral to weapon performance	• CBA lead: George Winters • Authors: Jack Ferguson, John Marciniak, Bob Webster • Facilitator: Jan Philpot • Site: John Dienes, Steve Dempsey, Brian Gesuale

Table 1-1. Appraisal Characteristics

continued on next page

**Appraisal
characteristics,
continued**

Organization	Project Domain	Domain	Appraisal Team
Navy Cruise Missile Weapon Systems Program Office	Development and PDSS for naval airbreathing cruise missiles three projects	Real-time ship-board weapon control systems	• CBA Lead: Brenda Zettervall • Authors: Jack Ferguson, Tony Guido, Jordan Matejcek • Facilitator: Jan Philpot • Site: Jim Blackwelder, Andrew Horne, Marty Martinez
ARDEC Fire Control and Software Engineering Division	Development and PDSS for gun-fired weapons systems, including Army mortars and self-propelled howitzers four projects	Real-time embedded weapon fire control systems	• CBA Lead: Jack Ferguson, Larry Jones (co-lead) • Authors: Jack Cooper, Mike Falat, Matt Fisher, Jack Ferguson • Facilitator: Scott Reed • Site: Laura Hojecki, Kalman Laudon, Patty Lyon, Joe Sierodzinski, Don Stewart

Table 1-1. Appraisal Characteristics (cont'd)

continued on next page

**Appraisal
characteristics,
continued**

Organization	Project Domain	Domain	Appraisal Team
DISA Applications Engineering Facility	Development and maintenance of applications for several information systems, including the global command and control system four projects	Information management and communication systems	• CBA Lead: Tara Rumsey • Authors: Jack Cooper, Mike Falat, Matt Fisher, Jack Ferguson • Facilitator: Scott Reed • Site: Prince Billups, Rosa Charity, Ken Kelley, Denise Richardson, Nancy Summers • Other: Fred Luppino, Loral Federal Systems

Table 1-1. Appraisal Characteristics (cont'd)

Model Issues

Overview of model issues

In general, the SA-CMM was viewed as an accurate model of software acquisition. Site team members and interview subjects reported that the SA-CMM describes "what they do or should be doing to acquire software-intensive systems."

The pilot appraisals resulted in 27 comment forms issued to the author team. Some specific questions were raised about the meaning of various words in the model and the need for more examples to explain some activities. Other comments are detailed in the remainder of this report.

Planning versus doing

The initial design of the model appears to overemphasize planning. Goal 1 of every KPA in Version 0.01 requires that the KPA be planned, and activities 1 and 2 in almost every KPA reinforce the need for plans. While level 2 of the model requires policies, plans, and procedures, the repetitive nature of these goals and activities is not evident in the Software CMM (SW-CMM) because the SW-CMM does not follow a template.

Following the template, with its emphasis on plans, and then following the plans made evident the repetitive nature of the writing, which detracted from the active parts of the model. Thus Version 0.02 of the SA-CMM corrected this problem by reducing one level of documentation: Instead of requiring policies, plans, and documented procedures for writing plans, SA-CMM Version 0.02 requires policies and plans, but not a documented procedure for writing plans. Draft templates for Version 2 of the SW-CMM also delete this documentation requirement.

Real and apparent overlaps

The pilot appraisals identified several overlaps and redundancies among the project office management (POM), contract tracking and oversight (CT&O), and evaluation and acceptance (E&A) KPAs of Version 0.01. Some of these overlaps and redundancies were corrected in Version 0.02, but not all. Some apparent overlaps—e.g., risk identification in POM with the software acquisition risk management (SARM) KPA—are intentional, since some lower level activities lay the foundation for higher level KPAs. In addition, better descriptions of the relationships between Level 2 and Level 3 KPAs are needed.

Added explanatory material

Some appraisals highlighted the need for a better explanation of the use of the model. Specifically, the introduction should emphasize that

- Maintenance is viewed as "the acquisition of maintenance" and is thus subject to appropriate KPAs just as is the acquisition of software development and software-related services.
- In-house developers and maintainers are considered as "contractors" by the model, thus the model's KPAs, with appropriate tailoring, apply to in-house development and maintenance.

Appraisal Methodology Issues

Tailoring of appraisal team training

The CBA IPI appraisal methodology was used for all pilot appraisals. Team training was modified from the training for the SW-CMM appraisals—one day was allotted for Introduction to the SA-CMM and two days were allotted for CBA IPI. The original course contains sections on interviewing individuals and on interviewing groups, along with associated data-consolidation sections. This was reduced to one section on interviewing techniques and one section on data consolidation. These changes were forwarded to the CBA IPI developers for possible inclusion in the course.

On-site appraisal schedule

The pilots were scheduled to occupy a nominal eight-hour work day as opposed to the marathon sessions usually associated with a CMM-based appraisal. Some of the time was recouped in the following ways:

- Because of the time proximity between the team training and the on-site appraisal, the kickoff briefing was combined with the assessment participants briefing and conducted during the week of team training.
- The initial document review was conducted as part of team training or during the period between team training and the appraisal.

For most of the pilots, this schedule did not usually provide data sufficiency to rate all KPAs, but, given the lack of maturity of the model, ratings were not a goal of these appraisals. The schedule allowed for only four or five interview sessions. To obtain deeper coverage and determine a rating might require another two or three days. As it was, KPA coverage was usually prioritized based on the SA-CMM maturity model questionnaire and initial interview results.

Appraisal team

Since the appraisal training includes both SA-CMM and CBA IPI, the appraisal team must have some knowledge of maturity modeling and the rationale behind model-based process improvement. With knowledgeable team members, the training of one day for the SA-CMM and two days for CBA methodology were sufficient. Future teams should attend at least an Introduction to the SA-CMM course followed by CBA IPI or software capability evaluation (SCE) training.

In light of organization issues discussed in the next section, site members of appraisal teams must have detailed insight into the organizational structure and business practices of the appraised organization.

Team training included a session in which interview questions were crafted for the target organization. This provided needed practice in understanding the model's application to the organization and understanding the organizational structure. In these appraisals, the team relied heavily on site team members knowledge of the organization.

**Organization
issues**

The pilot appraisal teams found that the structures of acquisition organizations are significantly more diverse than those of development organizations. Some organizations combine acquisition with development and maintenance activities; some are organized in traditional project-office fashion, while others have multiple integrated product teams; some combine the acquisition of PDSS for legacy systems with the acquisition of newer systems; some provide functional expertise to the program management/program executive office structure, while others are in the direct chain of command.

There was also variety in process-improvement experience—some organizations have existing process improvement groups and others do not. Those organizations with improvement groups were generally able to fold SA-CMM appraisal results into their ongoing improvement efforts. Others decided to start improvement programs as a result of the SA-CMM pilot appraisals.

This diversity means that significant pre-appraisal planning must be done and that more in-depth knowledge of the organization must be imparted to the appraisal team. Time was added to the training schedule for training by the site representatives and for tailoring the model and questions to the organization. In addition, organizational issues and scheduling complexities require at least one week's time between training and appraisal.

**Maturity
questionnaire**

A maturity questionnaire was used immediately after the in-briefing to obtain data from key managers on the extent of institutionalization of the SA-CMM KPAs and to help scope the appraisal. There were few questions raised about the questionnaire, but each pilot site required the definition of the "project" and "acquisition organization" terms as applied to their organization.

Many written comments were obtained from the questionnaire. These were collated by KPA and were used in the assessment process when needed.

Interviews

Interview questions were written by each appraisal team, with questions from previous appraisals used for background. Although practices in the SA-CMM KPAs formed the basis for questions, each organization required wording specific to that organization.

During the Navy appraisal, the team built an interview question template to help guide the interview process. This template helped teams organize interview sessions in later appraisals and will be incorporated into team training material.

All of the interview sessions were several on several, with project leader, functional area representative, and manager groups tailored by knowledge gained of the organizational structure. One lesson learned was that it is best to interview managers and project leads first and last, since they usually have knowledge about institutionalization that may be lacking in the functional areas.

There was some discussion concerning the use of directed versus open-ended questions. While directed questions help fill-in boxes in the KPA wall charts, they can result in yes/no answers that do not really describe how the organization works. Open-ended questions, however, may not yield answers to the desired practices and can lead to wandering, time-wasting answers. They can also result in blank stares, which provide information but can require significant team time to interpret. In addition, some answers apply to different KPAs and activities than those that generated the question. Tagging these answers to the model requires a significant depth of knowledge of the model. During the pilot appraisals, this depth was provided by the SA-CMM authors. Future teams that do not have author members must undergo a more formal Introduction to the SA-CMM course.

Some Common Appraisal Findings

**Apparent
value of
appraisal
results**

Each organization appraised believed that the results of the appraisal were generally valid, accurate, and useful for input to a self-improvement effort.

**Risk
management**

In general, pilot appraisals found a strong, proactive approach to software acquisition risk identification, analysis, and mitigation. While some of these activities were not integrated into a formal program, most projects were still actively reporting risks and mitigation plans at various management reviews.

Appendix A Outline of Briefing Format

Briefing format The following is an outline of the briefing format used:

The Assessment

- The SA-CMM Pilot
- The Assessment Team
- Pilot Assessment Objectives
- Assessment Activities
- Assessment Scope

SA-CMM

- SA-CMM Structure
- The SA-CMM Key Process Areas

Findings

- Findings Summary
- Global Findings
- Software Acquisition Planning
- Solicitation
- Requirements Development and Management
- Project Office Management
- Contract Tracking and Oversight
- Evaluation
- Transition and Support
- Level 3 Findings
- Non SA-CMM Findings

Next Steps: IDEALSM—An Integrated Approach to Process Improvement

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