



CarnegieMellon Software Engineering Institute

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Note: This document has been updated to a new version. If you want to see the newer document, see *Standard CMMISM Appraisal Method for Process Improvement (SCAMPISM), Version 1.1: Method Definition Document* (CMU/SEI-2001-HB-001, <http://www.sei.cmu.edu/publications/documents/01.reports/01hb001.html>).

SCAMPISM, V1.0
Standard CMMISM
Assessment Method for
Process Improvement:
Method Description,
Version 1.0

CMMI Product Development Team

October 2000

TECHNICAL REPORT
CMU/SEI-2000-TR-009
ESC-TR-2000-009



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CMM[®] Integration Project

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FOR THE COMMANDER



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Preface

The Capability Maturity Model Integration (CMMISM) project has involved a large number of people from different organizations throughout the world. These organizations have been using one or more CMM[®] models and are interested in the benefits of developing an integration framework to aid in enterprise-wide process improvement and integration activities.

The CMMI project is sponsored by both government and industry. Government sponsorship is provided by the U.S. Department of Defense (DoD), specifically the Office of the Under Secretary of Defense, Acquisition, Technology, and Logistics (OUSD/AT&L). Industry sponsorship is provided by the Systems Engineering Committee of the National Defense Industrial Association (NDIA).

Organizations from industry, government, and the Software Engineering Institute (SEI) have joined together to develop the CMMI Framework, CMMI model, CMMI assessment method, and supporting products. These organizations donated the time of one or more of their people to participate in the CMMI project.

Acknowledgments

Many talented people have been involved as part of the CMMI product development team. Three primary groups involved in this development are the steering group, product development team, and stakeholder/reviewers.

The steering group guides and approves the plans of the product development team, provides consultation on significant CMMI project issues, and ensures involvement from a variety of interested communities.

The product development team writes, reviews, revises, discusses, and agrees on the structure and technical content of the CMMI Product Suite,¹ including the model, training, and assessment materials. Development activities were based on an A-Specification provided by the

CMM, Capability Maturity Model, and Capability Maturity Modeling are registered in the U.S. Patent and Trademark Office.

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¹ The CMMI Product Suite is the set of products produced from the CMMI Framework, which includes models, assessment materials, and training materials.

steering group, the three source models identified in the A-Specification, and comments from stakeholder and steering group members.

The stakeholder/reviewer group of organizations provided valuable insight in the early effort that was used to refine the approach to the development of the product suite.

The CMMI product development team has had the benefit of two distinguished leaders during the past 2 1/2 years. Project manager Jack Ferguson, led the CMMI development team from the project's inception through to the release of CMMI-SE/SW V0.2. Project manager Mike Phillips led the team from the release of CMMI-SE/SW V0.2 to the present.

Members of the CMMI Assessment Methodology Team (AMT) played an important role in progressing the Assessment Requirements for CMMI (ARC) and the SCAMPISM Method Description document, and their contribution is gratefully acknowledged. During the course of the development work, Dr. Donna Dunaway (SEI), Dr. Rick Hefner (TRW), and Mr. David H. Kitson (SEI) chaired the AMT; in addition, Mr. Kitson and Dr. Dunaway served as managing editors of these assessment documents. The contribution of Mr. Will Hayes (SEI) to the content and structure of the document is also recognized and gratefully acknowledged. The efforts of these team members to lead the AMT and progress the documents through peer reviews and the publication process are also recognized and gratefully acknowledged.

Both present and emeritus members of the three groups involved in developing CMMI products are listed in Appendix F.

Where to Look for Additional Information

You can find additional information, such as the intended audience, background, history of CMMI models, and the benefits of using CMMI models, published in various sources. Many of these sources we have documented on the CMMI Web site, which is located at <http://www.sei.cmu.edu/cmmi/>.

Feedback Information

We are very interested in your ideas for improving these products. To help these products continually improve, see the CMMI Web site for information on how to provide feedback: <http://www.sei.cmu.edu/cmmi/>.

If you have questions, send email to cmmi-comments@sei.cmu.edu.

Abstract

This document describes the Standard CMMISM Assessment Method for Process Improvement (SCAMPI). The depth of information provided is suitable for a number of audiences, including potential sponsors of assessments, senior technical advisors, and individuals who may be assessment participants. This document explains the role of assessments in the context of the IDEALSM (Initiating, Diagnosing, Establishing, Acting, Leveraging) approach to software process improvement.

This document is not intended to provide in-depth information on how to conduct a SCAMPI assessment, perform detailed planning for an assessment, or train an assessment team. Those wishing to conduct a SCAMPI assessment in their organization should contact an SEI-authorized SCAMPI Lead AssessorSM to ensure that the assessment is performed by a trained, qualified individual who will conduct the assessment for the maximum benefit of the assessed organization. A list of SEI-authorized SCAMPI Lead Assessors is maintained on the SEI's Web pages at <http://www.sei.cmu.edu/managing/appraiser.listing.html>.

The SCAMPI method is based on the CMM[®]-Based Appraisal for Internal Process Improvement (CBA IPI) V1.1 assessment method [Dunaway 96b] and the Electronic Industries Alliance/Interim Standard (EIA/IS) 731.2 Appraisal Method [EIA 98b]. SCAMPI satisfies the Assessment Requirements for CMMI (ARC) V1.0 [SEI 00a] and is a Class A assessment method².

The SCAMPI method is a diagnostic tool that supports, enables, and encourages an organization's commitment to process improvement. The method helps an organization gain insight into its process capability or organizational maturity by identifying strengths and weaknesses of its current processes relative to one or more of the CMMI models, including the Capability Maturity Model[®]-Integrated for Systems Engineering and Software Engineering (CMMI-SE/SW) [SEI 00b, SEI 00c].

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SM SCAMPI, SCAMPI Lead Assessor, CMMI, and IDEAL are service marks of Carnegie Mellon University.

² A Class A assessment method is an in-depth assessment satisfying all Assessment Requirements for CMMI.

The SEI, as steward of the CMMI Product Suite, works to assure that any public comments or statements about maturity levels or ratings resulting from a SCAMPI meet quality and consistency criteria.

In this document, brief descriptions of method activities are provided with a discussion of tailoring options. Guidelines are provided for establishing resource requirements for conducting a SCAMPI assessment. The SEI Appraiser Program is discussed, detailing the qualifications required to become an SEI-authorized SCAMPI Lead Assessor. Interested parties should refer to the SEI Web site for complete and current information on the SCAMPI authorization process.

1 Background and Overview

Process assessments focus on identifying improvement opportunities within an organization. Assessment teams use CMMISM models, including the Capability Maturity Model - Integrated for Systems Engineering and Software Engineering (CMMI-SE/SW) model, to guide them in identifying and prioritizing findings. These findings, combined with guidance provided by the practices in the CMMI model, are used (by an engineering process group, for example) to plan an improvement strategy for the organization.

For organizations that wish to assess against multiple disciplines (e.g., software engineering and system engineering), the unified CMMI approach permits some economy of scale in model and assessment training. One assessment method can provide separate or combined results for multiple disciplines, while assessment of a single discipline is also supported. CMMI assessment products provide consistent findings for both staged and continuous representations through the use of equivalent staging.

The assessment principles used in the CMMI Product Suite are the same as those used in past assessments based on the CMM for Software (SW-CMM) and Systems Engineering Capability Model (SECM). These principles include the following:

- senior management sponsorship
- focus on the organization's business goals
- use of a documented assessment method
- use of a process reference model (e.g., a CMMI model)
- confidentiality for interviewees
- collaborative team approach
- focus on follow-on actions for process improvement

1.1 IDEALSM Approach to Process Improvement

The SCAMPI method is a diagnostic tool used to assess and characterize an organization's processes and is used in the larger context of process improvement. One recommended

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framework to be used with SCAMPI for process improvement is the IDEAL model, shown in Figure 1 [McFeeley 96]. The IDEAL approach consists of five phases: initiating, diagnosing, establishing, acting, and learning. Assessments are an integral part of the diagnosing phase of the IDEAL approach.

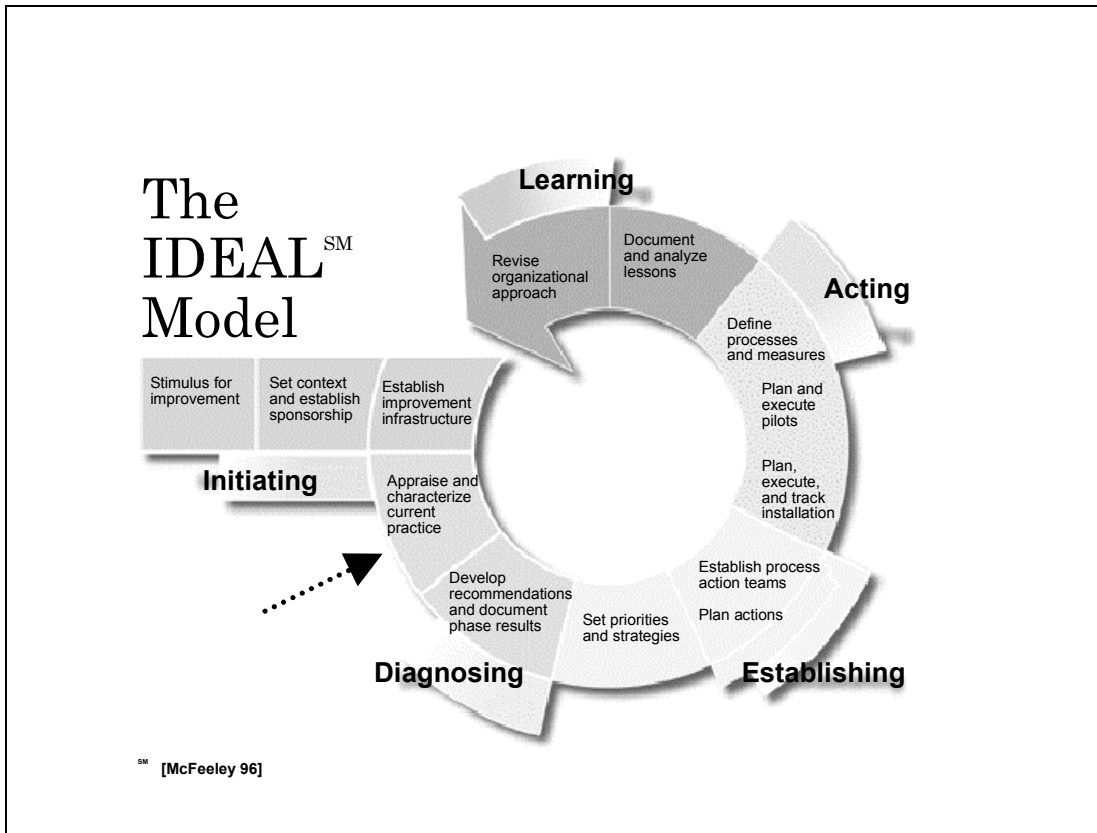


Figure 1 IDEAL Approach for Software Process Improvement

The initiating phase of process improvement should be undertaken successfully before the assessment start-up. The assessment establishes a baseline of organizational maturity and/or or process capability that forms the basis for follow-on process improvement activities. These activities are typically documented in an action plan and tracked to completion.

1.2 Results of Process Improvement Efforts

Published results show a strong relationship between model-based process improvement and organizational performance [Krasner 99, McGibbon 99, El-Emam 00]. A considerable amount of systematic empirical evidence has accumulated over the past two decades.

Numerous in-depth case studies have demonstrated substantial improvements in productivity, product quality, and return on investment in many organizations as they improve their process capabilities. For example, one study documented process improvement efforts in 13 or-

ganizations, and showed associated improvements in cycle time, defect density, and productivity, as well as benefit-to-cost ratios in the range of 4.0:1 to 8.8:1 [Herbsleb 94]. However, not all of the reported performance improvements in a case study necessarily are due to model-based process improvement.

Broader based studies that compare many projects or organizations can provide more confidence in the ability to generalize their results. One study surveyed 138 senior technical staff, project managers, and process improvement professionals representing 56 appraisals. The investigators found that personnel from higher maturity organizations reported better product quality, enhanced ability to meet schedule commitments, and similarly better results on several other indicators of organizational performance [Goldenson 95]. Other recent studies have found similar results using independent measures of schedule, budget, product quality, and other performance metrics [Harter 00, Krishnan 99, Clark 97, Lawlis 95].

The results of CBA IPI assessments are sent to the Software Engineering Institute (SEI), and these data are reported twice a year in industry aggregates in the Maturity Profile that can be found on the SEI Web site at <http://www.sei.cmu.edu/sema/profile.html>. Other significant process improvement results also have been surveyed and documented [Dunaway 98, Goldenson 95, Herbsleb 94, Hayes 95]. The evidence summarized here is largely from studies of software development processes. Results of EIA 731 assessments have not been centrally collected and analyzed, and comparable evidence based on improvement of systems engineering processes is not yet widely available. However the evidence thus far is encouraging [Sheard 00].

1.3 What is the SCAMPI Method?

The SCAMPI method is a diagnostic tool based on the Class A assessment method requirements in the ARC V1.0. The method enables an organization to do the following:

- gain insight into its development capability by identifying the strengths and weaknesses of its current processes
- relate these strengths and weaknesses to the CMMI model
- prioritize improvement plans
- focus on improvements that are most beneficial, given its current level of organizational maturity or process capabilities and considering its business goals
- derive capability level ratings as well as a maturity level rating⁴

The approach of the SCAMPI method is to assemble and train a competent assessment team under the leadership of a Lead Assessor and to conduct a structured series of data-gathering and analysis activities with people in the organization to understand their problems, concerns, and ideas for improvement. The method is enacted by a trained group of professionals who

⁴ This feature depends on an assessment scope which enables such derivations to be made.

work as a team to generate findings and, optionally, ratings relative to the CMMI model process areas within the assessment scope. The findings are generated from data collected from questionnaires, document review, and in-depth interviews with organization members involved in the enactment or management of the processes being examined.

The SCAMPI method has two primary objectives:

1. to support, enable, and encourage an organization's commitment to process improvement
2. to provide an accurate picture of the strengths and weaknesses of the organization's current process, using the CMMI model as a reference model, and to identify areas for improvement

1.4 What Can The SCAMPI Method Accomplish?

The business needs for process improvement drive the requirements for an assessment and generally include one or more of three closely related factors: (1) reducing costs, (2) improving quality, and (3) decreasing time to market. The fundamental premise of process improvement is that organizational processes significantly impact these factors.

Since the SCAMPI method is designed to support a variety of assessment needs, its results can support a variety of activities that require detailed knowledge about the strengths and weaknesses of the process, such as the following:

- establishing process action plans
- measuring actual progress against action plans
- identifying the best (most effective) practices within the organization for transition elsewhere in the organization

A primary objective of the SCAMPI method is to build on an organization's commitment, which was established during previous phases of the process improvement cycle. To support the goal of enabling and supporting an organization's commitment to process improvement, the assessment team and participants must understand the sponsor's business goals and allow for a collaborative shaping of the assessment scope. It is important that the organization owns and "buys in" to the assessment results, identifying the most critical issues that need to be addressed to sustain momentum for follow-on activities.

The other primary objective of the SCAMPI method is to provide an accurate picture of existing processes relative to the assessment reference model. To accomplish this, the assessment team must do the following:

- Identify strengths and weaknesses using the CMMI model as a reference model.
- Provide findings to the sponsor and the organization that are sufficiently complete to guide the organization in planning and prioritizing future process improvement activities.

- Optionally, provide capability level ratings of process areas and/or a maturity level rating of the organizational unit.
- Identify major non-CMMI issues that have an impact on process improvement efforts.

1.5 SCAMPI and Benchmarking

As a Class A assessment method relative to ARC V1.0, the SCAMPI method is an appropriate tool for benchmarking. Organizations that want to compare their own process improvement achievements with other organizations in the industry may have a maturity level determined as part of the assessment process. With the pressure to achieve maturity levels being placed on contractors and subcontractors, it is important to be clear about the assessment context when a maturity level is stated.

To understand the assessment context, the following information must be provided when claiming achievement of a maturity level:

What was the organizational scope of the assessment? For most organizations of significant size, only a part of the organization is usually selected for the assessment scope. Assessment results are valid only for the part of the organization being assessed and cannot be extrapolated to characterize a larger organizational scope than was specified in the assessment plan.

What was the model scope of the assessment? Which reference model was used in the assessment?; which representation was used?; which process areas within the model were investigated within the assessment scope? All of the process areas within a maturity level and for each maturity level below must be investigated to determine a maturity level. It is permissible to declare that some process areas are “not applicable” to the organization’s business; however, this must be clearly stated relative to a maturity level claim.

What assessment method was used? There are many assessment methods; some are more comprehensive than others. The SCAMPI method is a Class A method and therefore provides a high degree of confidence in the results.

Who conducted the assessment? The SCAMPI method requires that a Lead Assessor authorized in the SEI Appraiser Program lead the assessment. There are team member selection criteria that must be satisfied and training that must be completed to constitute a valid SCAMPI assessment team.

Can others see the assessment results? If an organization is contemplating a business arrangement with another company, and consideration of a maturity level is part of the decision-making process, it is legitimate for the organization to ask to see the assessment results for which the company is claiming a maturity level. The assessment results clarify the findings of each process area investigated and clearly indicate how the maturity level was derived by addressing each of the questions discussed above.

Decisions made on the basis of maturity level ratings are only valid if the ratings are based on known criteria. Most organizations are diligent in reporting accurate maturity levels; however, the absence of contextual information (discussed above) leaves maturity level ratings subject to widely varying interpretations. An educated community is the best defense against the misuse of information or inaccurate claims. The community must learn to ask the right questions and insist on getting complete answers.

Benchmarking can only be valid when there is a consistent basis for establishing the benchmarks. The SEI maintains industry aggregates of assessment results. These data are reported in industry maturity profiles gathered from organizations that have performed assessments since 1987. The profile is based on assessment data provided by SEI-trained professionals, and is updated twice annually. The latest profile is available for viewing and downloading at <http://www.sei.cmu.edu/sema/profile.html>.

2 SCAMPI Method Activities

The SCAMPI method has three phases. The first phase includes the activities necessary to plan and prepare for the assessment. The second phase consists of onsite activities for conducting the assessment, including techniques for gathering, organizing, and consolidating data. The final phase is to report the results. Each phase is described in the following sections.

2.1 Phase One: Plan and Prepare the Assessment

This section describes the activities that take place before the onsite phase. These activities are shown in Figure 2.

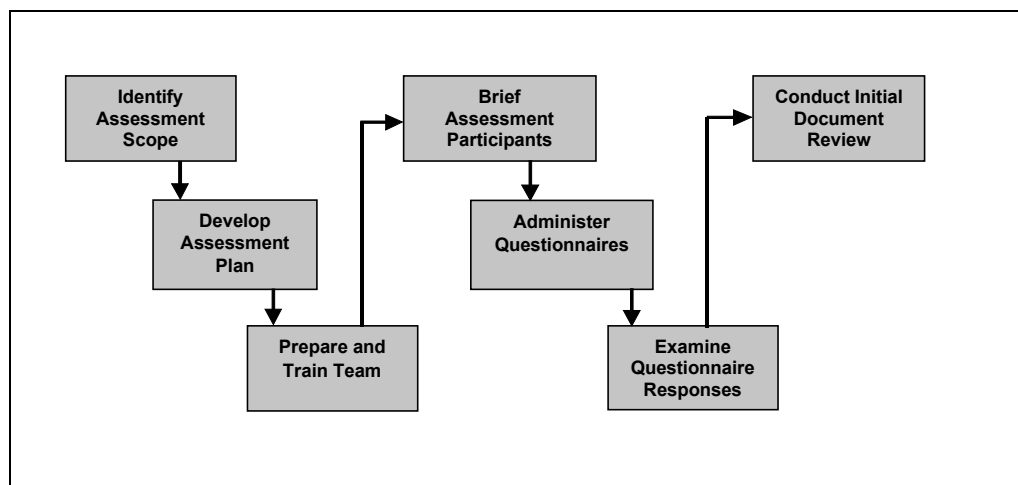


Figure 2 Pre-Onsite Activities

2.1.1 Identify the Assessment Scope

The purpose of identifying the assessment scope is to develop a common understanding between the assessment team leader and the sponsor concerning the assessment goals, scope, constraints, roles, responsibilities, and outputs and to obtain commitments to proceed with the assessment. The suitability of the assessment method relative to the assessment's purpose, objectives, and constraints must be affirmed as part of the assessment scope identification activity. The responsibility for ensuring that this determination occurs rests with the assessment team leader.

Because the CMMI Product Suite provides for multiple disciplines as well as the staged and continuous representations, this activity is relatively more complex than for similar undertakings using previous assessment approaches (such as CBA IPI or EIA/IS 731). The implications of assessment scope decisions are far reaching and have significant impact on the resource requirements for the assessment, even when a single discipline is being assessed.

During this activity the active involvement of the assessment sponsor is critical; clear expectations must be established and agreed to. A full understanding of the implications of choices made at this stage of the planning and preparation phase are one of the keys to a successful assessment.

2.1.2 Develop the Assessment Plan

A plan for conducting the assessment is developed based on the assessment goals identified by the sponsor and the assessment scope decisions made earlier. Included in the plan are detailed schedules for the assessment as well as any risks identified with the execution of the assessment. During this activity, a site information packet is developed that assists the assessment team in understanding the assessed organization. Assessment team members, projects, and assessment participants are selected according to defined criteria. Documents are identified for initial review, and the logistics for the onsite visit are identified and planned.

2.1.3 Prepare and Train the Assessment Team

When preparing and training the assessment team, the assessment team leader must ensure that each assessment team member has received adequate CMMI model training (at least equivalent to the three-day Introduction to the CMMI model course licensed by the SEI) prior to being trained in the SCAMPI method. The team leader then conducts the three-day SCAMPI Assessment Team Training, so that each team member understands the assessment process, its underlying principles, the tasks necessary to execute it, and each person's role in performing the tasks. Team training is followed by planning sessions that include establishing ground rules for the assessment, discussing the details of the assessment, and scripting interview questions in preparation for the onsite period.

2.1.4 Brief Assessment Participants

The purpose of briefing assessment participants is to ensure that the assessment participants understand the assessment process and have a clear set of expectations regarding its outcomes as well as an understanding of the role they will play in the assessment. Assessment participants consist of organizational members who will play an active role during the assessment by providing data for the assessment team.

2.1.5 Administer CMMI Appraisal Questionnaire

Information about the organization's processes is collected from selected members of the organization using the CMMI appraisal questionnaire (or equivalent). This information is used

to provide team members with an overview of the organization's process capability. Often, comments on the questions provide more value to the team than the "yes" and "no" responses. Documents that are noted on the questionnaire as relating to the practices provide an initial inventory of documentation that must be collected prior to the assessment team's arrival onsite.

2.1.6 Examine Questionnaire Responses

The assessment team members examine the pattern and nature of responses on the CMMI appraisal questionnaires completed by site personnel. The results of this investigation typically suggest areas for further examination during subsequent interviews and document reviews, and assist the team in focusing their investigations. In addition, questionnaire responses may be used for corroboration of observations originating from other data sources.

2.1.7 Conduct Initial Document Review

An initial set of documents pertinent to the organization's processes is collected prior to the arrival of the assessment team for the onsite phase of the assessment. The team then reviews the documentation to find additional areas for investigation, to understand the life cycle(s) in use by the organization, and to map organization data to the CMMI model. Organizations are strongly encouraged to have a cross-reference mapping in place that will enable the assessment team to locate documents relevant to CMMI model elements quickly. Information from the CMMI appraisal questionnaire is used in constructing the mapping of cross-references. Having this mapping available shortens the duration of the onsite phase where additional document review will take place.

2.2 Phase Two: Conduct the Assessment

This section describes the activities that take place during the onsite period. These activities are illustrated in Figure 3.

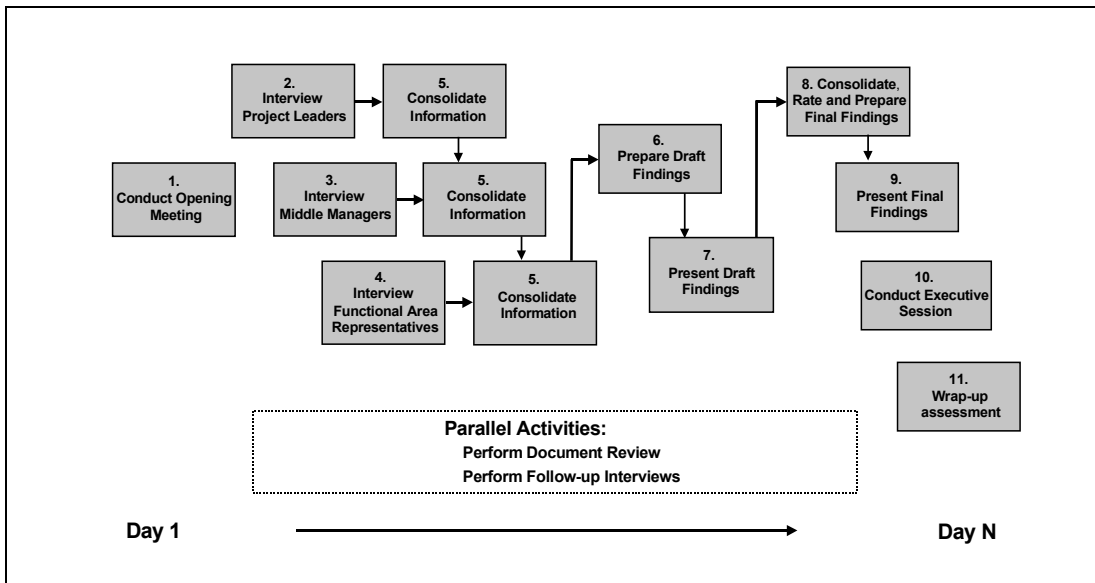


Figure 3 Chronology of Onsite Activities

2.2.1 Conduct an Opening Meeting

Conducting an open meeting constitutes the formal beginning of the onsite visit and reaffirms participants' expectations concerning the assessment activities. The sponsor of the assessment typically opens the presentation to show support and urge participants to be forthcoming in interview sessions.

2.2.2 Conduct Interviews

The purpose of interviewing is to do the following:

- Identify areas that people believe can and should be improved in the organization, to understand how the work is performed.
- Understand the processes in use.
- Ensure coverage of the CMMI model within the scope of the assessment across the organization, as defined in the scope.

The set of individuals from the assessed organization to be interviewed is dependent on the CMMI model scope and the organizational scope of the assessment. Identification of the appropriate individuals to be interviewed takes place during the planning phase of the assessment. Typically there are three groups of individuals interviewed at this stage in the assessment process—project leaders, middle managers and functional area representatives.

The assessment team interviews project leaders individually. These interviews generally address issues associated with project management and the processes in use on the project.

Middle managers are interviewed as a group to understand the middle management perspective of how the work is performed in the organization, any problem areas of which they are aware, and improvements that they feel need to be made.

Functional area representatives (FARs) are interviewed to collect data within the scope of the assessment and to identify areas that the practitioners believe can and should be improved in the organization. Typical FAR sessions include 6-12 people grouped by areas such as engineering process group (EPG), requirements, implementation, verification, and validation.

2.2.3 Consolidate Information

The purpose of consolidating information is to summarize and consolidate information into a manageable set of observations that are categorized according to the process areas of the CMMI model. All observations are validated using the rules of corroboration. The team must reach consensus on the validity of observations and whether sufficient data in the areas being investigated have been collected. The assessment team is responsible for obtaining sufficient information to cover the organization, the development life cycle, and the CMMI model components within the assessment scope before any rating can be done. The responsibilities for guiding the consolidation efforts for individual process areas are usually divided among team members.

2.2.4 Prepare Draft Findings Presentation

Draft findings are generated from the observations in preparation for obtaining feedback from the assessment participants who have provided the information through interviews. Ratings are not considered until after the draft findings are presented, as the assessment team is still collecting data.

2.2.5 Present Draft Findings

The purpose of presenting draft findings is to obtain feedback from the assessment participants on the assessment team's draft findings. Feedback is recorded for the team to consider after all of the draft findings are presented. Draft findings are presented in multiple sessions to help assure non-attribution.

2.2.6 Consolidate, Rate, and Prepare Final Findings

The assessment team consolidates additional data obtained during the presentation of draft findings and from any follow-up interviews and document reviews. When the team has satisfied all coverage criteria for the assessment, the rating process can begin.

2.2.6.1 Special Considerations for Assessments Using the Continuous Representation

Since an assessment using a continuous representation may have a model scope of only a single process area, full coverage of the CMMI model effectively means that all process areas

declared (in the assessment plan) as the model scope of the assessment are covered adequately. Similarly, the organizational and life-cycle scope as declared in the assessment plan must be covered adequately. A continuous-based assessment has the additional consideration of coverage of the measurement scale for process capability (generic goals and practices).

Technically, each process area assessed can have its own unique measurement scope; typically, however, the process capability scope for each of the process areas assessed will be identical. The assessment team must ensure that the coverage criteria for the process capability scope of each process area are satisfied. Once adequate coverage of the assessment scope—as described above—is achieved, the rating process can begin.

The rating process consists of assigning a goal-satisfaction rating to each generic goal in scope for each process area in scope. If the assessment encompasses ten process areas and the process capability scope is capability levels one through three (for each of the process areas) then ratings must be assigned to a total of 30 generic goals. Capability levels one through three have one generic goal each for a total of three generic goals; each of these must be rated for each of the ten process areas. In addition, the rating of the generic goal for capability level one requires, in turn, that all of the specific goals for each process area be rated; thus there is an induced requirement for rating of all of the specific goals encompassed by the collection of process areas selected as the model scope.

Ratings are always established based on a consensus of the entire assessment team. For each goal, the team reviews all of the weaknesses that relate to that goal and asks: “Do the weaknesses, in aggregate, have a significant negative impact on the goal?” If so, the goal is rated “unsatisfied;” otherwise, it is rated “satisfied.”

Determination of capability level ratings to process areas is optional at the discretion of the sponsor. For a capability level to be achieved, all of the generic goals at and below the assigned capability level must be satisfied. For example, for a process area to be rated at capability level three, all generic goals at level three and below must be investigated during the assessment and rated “satisfied” by the assessment team. The achievement of capability level one or above implies that all of a process area’s specific goals are also rated “satisfied.”

2.2.6.2 Special Considerations for Assessments Using the Staged Representation

When the team has achieved full coverage of the CMMI model, the organization, and the life cycle, the rating process may begin by rating each goal for each process area within the assessment scope. Ratings are always established based on a consensus of the entire assessment team. For each goal, the team reviews all of the weaknesses that relate to that goal and asks: “Do the weaknesses, in aggregate, have a significant negative impact on the goal?” If so, the goal is rated “unsatisfied;” otherwise, it is rated “satisfied.”

For a process area to be rated “satisfied,” all goals for the process area must be rated “satisfied.” A process area may be rated “satisfied,” “unsatisfied,” “not applicable,” or “not rated.”

The determination of a maturity level rating is optional at the discretion of the sponsor. For a maturity level rating to be achieved, all of the process areas within and below the assigned maturity level must be satisfied. For example, for an organization to be rated at maturity level three, all process areas at level three and at level two must have been investigated during the assessment, and all of the process areas must have been rated “satisfied” by the assessment team.

2.2.6.3 Final Findings Presentation

The final findings presentation is developed by the team to present to the sponsor and the organization. Included in the presentation are the strengths and weaknesses observed for each process area within the assessment scope, the ratings of each process area, and the maturity or capability level ratings, if desired by the sponsor.

2.3 Phase Three: Report Results

The final phase of SCAMPI includes reporting results to the assessment sponsor and to the CMMI Steward, which is the Software Engineering Institute (SEI).

2.3.1 Present Final Findings

The team leader, or designated presenter, presents the assessment results to the sponsor. The sponsor owns the assessment results and is free to use them as he or she wishes. During the final findings presentation, the presenter must ensure that the organization understands the issues that were discovered during the assessment and the process issues that it faces. Organizational strengths are presented to validate what the organization is doing well. Strengths and weaknesses are presented for each process area within the assessment scope as well as any non-CMMI model issues that affect each process. If the assessment plan calls for the determination of ratings, a process area profile is presented showing the individual process area ratings.

2.3.2 Conduct the Executive Session (Optional)

The purpose of conducting an executive session is to allow the senior site manager to clarify any issues with the assessment team, to confirm his or her understanding of the process issues, and to secure guidance regarding the focus, timing, and priorities of the recommendations report and follow-on activities. Whether or not to conduct the executive session is at the discretion of the senior site manager.

2.3.3 Wrap-Up of the Assessment

The team leader collects feedback from the assessment participants and the assessment team on the assessment process, collects information that needs to be reported to the CMMI Steward, and assigns responsibilities for follow-on activities.

2.4 Follow-On Activities

To fully realize benefit from the assessment, the organization must have an improvement infrastructure in place. This infrastructure is in the form of sponsorship, the establishment of an engineering process group (EPG), CMMI model training for the organization, and so forth.

The assessment team may develop recommendations and document the assessment results immediately following the final findings briefing. A final report is optional but recommended. If the sponsor does not require a final report, one of the team members is responsible for collecting the assessment details, removing all attribution, and making these details available to the action planning team.

These assessment details are critical for prioritizing issues, developing the action plan, and implementing the establishing phase of the IDEAL approach. The establishing phase offers benefits including an organized and planned approach to process improvement; a clear understanding of costs, schedules, and resources; and the opportunity to plan for actions that the organization has the capability to achieve.

It is important to move into the establishing phase soon after completion of the assessment, so that momentum from the assessment can be maintained and the staff's expectations can be managed. Since an assessment provides expectations for improvement in an organization, follow-on activities are very important to avoid disappointment or disillusionment by the assessment participants.

If a 15504-conformant assessment has been planned, then the construction of a 15504 process profile is undertaken.⁵ This activity makes use of the translation mechanism provided for the SCAMPI method.

⁵ A 15504-conformance assessment is one which satisfies the requirements identified in ISO 15504-2 and 15504-3 [ISO 98b, ISO 98c].

3 Understanding SCAMPI: Core Concepts

The following sections provide information about the fundamental concepts and principles used by the SCAMPI method.

3.1 Conceptual Overview of SCAMPI Information Flows and Transformations

This section provides a focused look at some of the fundamental concepts and principles that underlie the SCAMPI approach to gathering data and transforming it into final findings (strengths, weaknesses, ratings). This discussion is not conducted at the procedural level that would be followed by an assessment team, but rather at the conceptual data transformation level. In this way, the key ideas and principles can be more clearly elaborated and communicated.

The following information is considered essential for an understanding of the SCAMPI method and is characterized as the “heart and soul” of the method. The majority of the SCAMPI method is geared toward implementing the data gathering and transformation “engine” described below. The hierarchy of data types (listed from lowest to highest level in the hierarchy) employed by SCAMPI is as follows:

1. **Notes (lowest level)** are notes taken by assessment team members about the information they have seen or heard during data gathering sessions.
2. **Observations** are written records that represent the assessment team members’ collective understanding of information either seen or heard during the assessment-data-collection activities. These observations are based on the notes of one or more assessment team members.
3. **Validated observations** are observations that the assessment team members agree are a) accurate, b) corroborated, and c) consistent with other validated observations.
4. **Draft Findings** are pre-rating determinations of an assessment team derived from valid observations about the state of the organization’s processes relative to the CMMI model scope of the assessment.
5. **Findings** are the conclusions of an assessment that identify the most important issues, problems, or improvement opportunities within the assessment scope.
6. **Final Findings** are the conclusions of an assessment that identify the most important issues, problems, or improvement opportunities within the assessment scope as well as the ratings rendered by the assessment team (if requested by the assessment sponsor).

Table 1 provides a summary of the series of information transformations that constitute the core of the SCAMPI method approach to data collection and analysis. Notice that there are more detailed information transformations defined in Table 1 than are listed above.

Item	What	When	Why
Note	The individual assessment team member (ATM) records data in their ATM notebook.	During any data collection activity	Data is considered to be significant and relevant to the determination of organizational unit compliance with the CMMI model.
Draft Observation	The ATM or PA mini-team synthesizes observations from notes.	During the Consolidate Information activity	The purpose of this transformation is to extract the import of one or more notes.
(Accurate) Observation	The assessment team agrees that the observation meets the accuracy criteria.	During the Consolidate Information activity	Observations are framed in a way most useful and relevant to the determination of practice implementation. Individual PA mini-team observations are synthesized into a single set.
(Valid) Observation	The assessment team decides the observation is valid.	During the Consolidate Information activity	The purpose of this transformation is to ensure that the information meets the SCAMPI requirements for validity (accurate, has been corroborated, and is consistent with other valid observations).
Draft Findings	The assessment team synthesizes valid observations into draft findings.	During the Prepare Draft Findings activity	By preparing the draft findings presentation to be used, this transformation provides the basis for soliciting feedback from assessment participants.
Final Findings (1)	The assessment team modifies draft findings as per feedback and/or adds new findings based on observations that are identified and corroborated in follow-up data gathering sessions.	During the Consolidate, Rate and Prepare Final Findings activity	Note that a pre-condition for rating is that the team has determined that sufficient data has been gathered.
Final Findings (2)	The assessment team determines ratings that are required as part of the assessment output.	During the Consolidate, Rate and Prepare Final Findings activity	This transformation prepares the information for reporting the results to the assessment sponsor.

Table 1 SCAMPI Information Transformations

3.1.1 Drivers for Data Collection

There are several factors that influence and guide the data collection efforts of SCAMPI assessment teams. First, the need to have reasonable assurance that the assessment results are based on findings of fact that are verifiable. Towards this end, the method imposes corroboration requirements that are essentially “rules of evidence.”

Second, the method imposes sufficiency constraints designed to ensure that enough information has been gathered to justify the rendering of goal ratings. Although these sufficiency criteria can be adjusted upwards for a particular assessment, the method establishes a lower limit on the amount of information that the team must establish as “findings of fact” before goal ratings can be rendered. This constraint has a profound impact on the behavior of the

team during the onsite period because the satisfaction of the sufficiency constraints determines when enough information has been gathered on a particular model practice.

3.1.2 Data Sources

SCAMPI relies on three primary sources of data for consideration by the assessment team:

1. instruments completed by assessment participants
2. discussions/interviews with assessment participants
3. documents produced by the organization

3.1.3 Data Sources to Notes

Irrespective of which source of data is being used, all data gathering begins with consideration by an individual assessment team member. This team member decides whether the data is worthy of capture as a note in the assessment team member's notebook. The basic criteria used in making this determination are (1) whether it provides useful input for understanding the context in which processes are being implemented or (2) whether it is pertinent to the determination of the extent of model process implementation (and therefore goal achievement).

Process context notes are useful notes for the assessment team member and do not progress further unless they are useful in subsequent team discussions.

Notes that relate the organization's actual enactment of processes that correspond to the CMMI model being used as the assessment reference model provide the basis for observations—the foundation data construct of the method.

3.1.4 Notes to Observations

The SCAMPI method intersperses data collection sessions with consolidation activities. Following data collection sessions (such as “Administer CMMI Appraisal Questionnaire” or “Interview Project Leaders”) assessment team members review their notes and consider either individually or in small teams what they have learned that has potential significance for findings and ratings. Information of this type is formulated into an observation—the unit of “fact” or “evidence” for the assessment method.

Observations are relatively detailed statements of what the assessment team member considers to be important factual information that pertains to process implementation. Typically the observation relates one or more CMMI model practices to what has been observed about the organization being assessed. The SCAMPI method requires a minimum of two valid observations (per model practice) for an assessment team to conclude that adequate information has been collected.

Since the end objective for the assessment team is to make determinations of goal satisfaction, the team naturally focuses on information that is germane to the implementation of model practices (since goal satisfaction presumes practice implementation).

3.1.5 Observations to Valid Observations

The transformation of observations to *valid* observation is of critical significance in the SCAMPI method. When the team agrees to this classification change, the team is accepting the content of the observation as a finding of fact that will be carried forward to be used to formulate draft findings. Accordingly, there are several tests that an observation must successfully pass to make the transformation from observation to valid observation.

First, the team must agree to its accuracy—that is, the observation has been determined (by the assessment team) to be all of the following:

- a) worded appropriately
- b) based on information seen or heard
- c) relevant to the assessment reference model being used
- d) significant
- e) not redundant with other observations

Second, the observation has been corroborated. Just as there are sufficiency criteria establishing a minimum number of valid observations that must be established, there are minimum requirements for establishing confidence in the accuracy of an observation.

Finally, the observation must be consistent with other valid observations. The absence of consistency means that either the candidate observation is not accurate or an observation previously promoted to valid status must be re-examined.

3.1.6 Valid Observations to Draft Findings

Once the assessment team has determined that it has adequate valid observations to satisfy the sufficiency criterion for all practices in the assessment scope, it is ready to formulate draft findings. Draft findings are pre-rating determinations that an assessment team derived from valid observations about the state of the organization's processes relative to the CMMI model scope of the assessment. Draft findings are typically classified into strengths and weaknesses.

Since the next step is to ask for feedback from the assessment participants on the accuracy of the draft findings, the assessment team typically synthesizes the valid observations at hand into a smaller number of assertions that focus on the extent to which model practices are or are not implemented. A useful framework for doing this is to categorize the draft findings into strengths (statements that a model practice is being performed according to the expectations of the model) or weaknesses (statements that a model practice is not being performed according to the expectations of the model).

3.1.7 Draft Findings to Final Findings

While the assessment team has satisfied the sufficiency criteria to the extent possible at this stage of the assessment process for each practice within the assessment scope (a pre-requisite to goal rating), there is still an important validation activity to perform—conduct a reality check of the assessment team’s tentative findings of fact with the assessment participants. Once draft findings have been synthesized, the assessment team requests feedback from key assessment participants (typically project managers, functional area representatives, and possibly others) on the extent to which the draft findings are accurate in the context of the assessment scope. Once this feedback has been obtained, the assessment team once again reviews its set of observations and draft findings and makes adjustments as needed to accommodate the feedback they receive.

When this activity has been completed, the assessment team is ready to rate goals. A goal is rated "satisfied" if the aggregation of findings (strengths) support the determination that (1) each of the practices or alternative practices⁶ that map to the goal are implemented, and (2) the aggregation of findings (weaknesses) do not have a significant negative impact on achievement of the goal.

The final findings consist of the conclusions of an assessment that identify the most important issues, problems, or improvement opportunities within the assessment scope as well as the ratings rendered by the assessment team (if requested by the assessment sponsor).

3.2 SCAMPI Roles and Responsibilities

To ensure that a SCAMPI assessment has a successful impact on the assessed organization, many factors need to be carefully considered. Foremost, the person who leads the assessment team must be well qualified and trained. In addition, members of the assessment team must meet certain criteria. Furthermore, the selection of the assessment participants must cover adequately the scope of the assessed organization.

3.2.1 Assessment Sponsor (or Senior Site Manager)

The senior site manager is the person who acts as the sponsor of the assessment and works with the assessment team leader to tailor the assessment to align it with the business goals of the organization. The sponsor has a number of responsibilities in addition to continually working with the assessment team leader to ensure the success of the assessment. The sponsor is also responsible for the following:

1. Verify that the assessment team leader has the necessary competence and skills to take responsibility for and lead the assessment.

⁶ An alternative practice is a practice that is a substitute for one or more practices contained in the CMMI model that achieves an equivalent effect toward satisfying the goal associated with the practices.

2. Ensure that the appropriate organizational units or subunits (e.g., projects, functional units) participate in the assessment.
3. Support assessment method provisions for ensuring non-attribution to assessment participants.
4. Ensure that resources are made available to conduct the assessment.

There may be circumstances where the sponsor of the assessment represents a corporate process-improvement organization, and the senior site manager is in charge of the organization being assessed. In that instance, the team leader must differentiate the roles of the sponsor and the senior site manager, and both must approve the assessment plan.

3.2.2 SCAMPI Assessment Team Leader

An SEI-authorized SCAMPI Lead Assessor must lead a SCAMPI assessment. Experience in performing various assessments has proven that it is critical for assessments to be led by qualified and well-trained individuals to achieve accurate results in a reasonable amount of time and to achieve a successful organization intervention. SCAMPI assessment team leaders must have relevant discipline experience, CMMI model knowledge and experience, and training in assessment technology.

By having well-trained and qualified assessors, different assessors should get similar results in organizations of similar maturity. The SEI Appraiser Program is designed to maintain the quality of appraisal leaders within the community. The SEI strives to ensure the continued confidence of the global community in the application of appraisal technologies. Lead Assessors are authorized within the program to perform SCAMPI assessments using copyrighted SCAMPI materials.

Lead Assessors are authorized to market and perform assessments either for third-party organizations or for their own organizations' internal use. Semi-annually the SEI publishes the SEI Appraiser Directory, which lists all currently authorized Lead Assessors. A copy of this directory and detailed requirements for a person to qualify as a Lead Assessor are available from the SEI Customer Relations Office and at the SEI Web Center. Appendix E describes the SEI Appraiser Program.

3.2.3 Assessment Team Members

The size and qualifications of the assessment team, as well as any potential biases of site team members, may affect the confidence the sponsor has in the assessment results. For example, a potential conflict of interests may influence a team member who has process improvement responsibilities.

Selecting the assessment team takes into account the knowledge, skills, and abilities of the assessment team as a whole as well as each individual team member. The team as a whole must have the collective knowledge, skills, and abilities to conduct a SCAMPI assessment for the particular organization being assessed. Team members are selected so that their combined

experience and skills match what is required for the assessment, including relevant qualifications for the reference model being used in the assessment. An assessment team contains a minimum of four individuals; a typical range for team size is 6-10.

Team size considerations include the following:

- Smaller teams may have difficulty performing extensive document review and achieving accuracy in interviewing activities.
- Larger teams require more coordination and time to come to consensus on the judgments that need to be made by the team as a whole.

Factors to be considered in selecting assessment team members include the following:

- Knowledge of process-improvement concepts: All team members must be knowledgeable in this area.
- Knowledge of at least one of the specific disciplines to be assessed.
- Engineering field experience: The team must have a minimum of 25 years of combined field experience in each of the disciplines to be assessed. The average experience for individual team members must be at least six years, with no team member having less than three years of field experience.
- Management experience: The team must have a minimum of ten years of combined management experience, and at least one team member must have six years of management experience.
- Life-cycle phases and functional activities experience: Seventy-five percent of the team members must have experience in at least one-third of the organization's life-cycle phases and their associated functional activities. At least two team members must have had experience in each life-cycle activity.
- Organizational environment, applications, and existing process knowledge: At least one team member must be knowledgeable in both the organization's environment and application domain. Site team members are important to the team; however, these team members must not have a vested interest in the assessment results.
- Team skills: Each team member must have good written and oral communication skills, the ability to facilitate the free flow of information, and the ability to perform as team players and negotiate consensus.
- Credibility: Each team member must have credibility with senior management, respect within the organization, and the ability to influence people.
- Motivation and commitment: Each team member must demonstrate the motivation to improve the process, the commitment to act as a change agent, and the willingness to do what it takes to achieve assessment goals.

Team members should not be managers of one of the selected assessment projects or within the direct supervisory chain of any of the anticipated interviewees.

3.2.4 Assessment Participants

Selecting assessment participants includes the selection of projects and project leaders, questionnaire respondents, and functional area representative interviewees; the number and characteristics of each must be a representative sample of the organizational unit as defined by the organizational scope of the assessment.

3.2.5 Projects and Project Leaders

Projects may be selected for the assessment where detailed investigations will be focused. If a project is selected for the assessment, the project leader and selected members of the project staff will participate in project leader and functional area representative interviews. Selected projects should represent the organizational entity being assessed as identified by the organizational scope.

Factors to be considered in project selection include how closely the selected projects represent variations in the organizational unit's projects in the following areas: application type and domain, technology employed, and scope in terms of product size, staff size, duration, and life-cycle phases. Selected projects should be at varying points in the life cycle with emphasis on later stages. In addition, project selection should account for the impact of the project on the business in terms of revenue, profit, or strategic value.

The portion of the organizational unit represented by the projects, both in terms of number of projects and number of staff, affect the confidence of the results. The recommendation is to select a minimum of four projects.

The goal of selecting project leader interviewees is to select a group of people that is a representative sample of the organizational unit's management staff at the project level and, in some instances, below the project level. The assumption is that this goal is achieved by selecting projects that are representative of the organization and interviewing their management staff.

Generally, the project leader interviewees include individual leaders of the projects selected for the assessment. However, in certain cases, the project leader may be removed from day-to-day management with development responsibilities distributed across several lower-level managers. In such cases, the project leader may be selected in addition to a combination of functional managers, such as the systems engineering manager, the configuration manager, the test manager, and so forth.

The leader of each project is interviewed individually. If more than one individual from the project's management chain must be involved in the interview, none of the individuals should be in the reporting chain of any of the others.

3.2.6 Selecting Middle Management Participants

Site representatives who fall between the project leaders and the senior site manager in the organizational hierarchy and have an impact on the development process are referred to as middle managers. These managers will participate in one or more group interviews. The purposes of interviewing middle managers are the following:

- to identify areas people believe can and should be improved in the organization, to understand how the work is performed (with a focus on management activities), to understand the processes in use at the project level
- to identify differences in process among projects
- to understand the relationship between the organization-level processes and the project-level processes
- to ensure coverage of process areas across the organization

3.2.7 Selecting Functional Area Representatives (FARs)

The goal of selecting FAR interviewees is to select a group of people that forms a representative sample of the organizational unit's technical staff. FAR interviewees should be practitioners, not managers or staff. They should include opinion leaders, and their managers should be committed to process improvement. It is desirable to have FARs who have the interpersonal skills required to facilitate a free flow of information during the FAR interview sessions. The FARs as a group must have characteristics or attributes (e.g., experience) that closely resemble those of the organizational unit's population. The FAR interview sessions should include persons from each of the projects that were selected for specific investigation, as well as individuals from other projects.

No two individuals who have a reporting relationship to each other should be in a FAR interview session together. Generally, each FAR session should have four to eight participants.

3.2.8 Selecting Questionnaire Respondents

The size and composition of the group of organizational respondents to the CMMI appraisal questionnaire deserves careful consideration. The organization has some latitude in terms of the extent to which questionnaire responses will be used to support the corroboration of observations formulated by the assessment team. The questionnaire is used as one source of data for the onsite activities, and to some extent, can substitute for seeking the same information during interviews. The recommended number of projects asked to respond to the questionnaire is between four and ten.

Depending on the model scope of the assessment and the available time, the leaders of the selected projects may provide answers to all of questions. However, given the size and detail of the questionnaire, consideration must be given to selecting additional respondents within

the project who have first-hand knowledge of the subject matter and can represent the selected project leaders and lead technical staff.

The questionnaire may be administered in either a group session with a facilitator available to clarify terminology when needed or individually over a one- to two-week period of time. In the latter case, the project leader who is responsible for completion of the questionnaire may have others in his or her project answer parts of the questionnaire for which they have the most knowledge. The organizational unit coordinator is responsible for collecting the questionnaires when they are completed, putting the responses into a summary form that is clear for the assessment team members, and then providing the summaries to the team members.

The questionnaire allows the notation of artifacts relevant to the practices requiring documentation. This notation of artifacts provides the organizational unit coordinator with the initial inventory of documents that need to be collected prior to the assessment team's arrival onsite.

3.2.9 Organizational Unit Coordinator

The organizational unit coordinator is responsible for handling the logistics of the assessment and for developing the schedule, notifying the assessment participants of the schedule, making sure that adequate rooms have been reserved for both the pre-onsite and onsite periods, making and distributing copies of the schedules, making sure that all of the necessary supplies and equipment are available when needed, scheduling contingency interviews, requesting additional documentation, and taking care of meals. The organizational unit coordinator should be a member of the assessment team. The organizational unit may consist of one or more physical site locations and it may be convenient to have multiple corresponding local site coordinators to assist the organizational unit coordinator.

3.3 Assessment Requirements for CMMI (ARC)

The Assessment Requirements for CMMI (ARC) [SEI 00a] defines the requirements considered essential to assessment methods intended for use with CMMI models. The ARC constitutes a set of guidelines for developing, defining, and using assessment methods in conjunction with one or more CMMI assessment reference models. The ARC provides requirements for multiple types of assessment methods with guidelines for determining the suitability of a particular assessment method. Suitability considerations include the accuracy and repeatability of assessment results.

The ARC uses the CMMI models as its associated assessment reference models. The CMM Appraisal Framework (CAF) V1.0 was produced originally to provide a common basis for assessment methods employing the SW-CMM V1.1 [Masters 95]. With the incorporation of CMMs into the CMMI architecture, the ARC has been designed to address these new models and the resulting impacts of the staged and continuous representations of each model as well as to recognize the emerging international standard on process assessment, ISO/IEC 15504. ISO/IEC 15504 consists of nine docu-

ments, *Concepts and Introductory Guide (15504-1)*, *A Reference Model for Processes and Process Capability (15504-2)*, *Performing an Assessment (15504-3)*, *Guide to Performing Assessments (15504-4)*, *An Assessment Model and Indicator Guidance (15504-5)*, *Guide to Competency of Assessors (15504-6)*, *Guide for Use in Process Improvement (15504-7)*, *Guide for Use in Determining Supplier Process Capability (15504-8)*, and *Vocabulary (15504-9)* [ISO 98a, ISO 98b, ISO 98c, ISO 98d, ISO 98e, ISO 98f, ISO 98g, ISO 98h, ISO 98i].

The ARC plays an important role in helping to assure an acceptable level of consistency in rating outcomes across multiple disciplines and assessment methods. It also helps assessment method developers, sponsors, and users understand the tradeoffs associated with various methods. According to the requirements of the ARC that are incorporated into an assessment method, it can be determined if the method is Class A, Class B, or Class C.

The SCAMPI method is a Class A method and, therefore, satisfies all of the ARC requirements. Other CMMI-based assessment methods may be appropriate for a given set of sponsor needs, including self-assessments, initial assessments, quick-look or mini-assessments, incremental assessments, and external audit evaluations. Method developers are expected to develop a variety of assessment methods within the ARC class definitions to meet these needs.

Whether a method developer complies with the ARC, and how it implements ARC requirements is a method-specific choice. It is up to users of assessment method outcomes to translate the results of ARC assessments into meaningful information that meets the sponsor's business needs. When an assessment method meets all of the ARC requirements, it is said to be fully ARC-compliant.

The ARC is the basis for the SCAMPI method. Based on years of experience with process assessment, it seems apparent that the community would benefit from having available additional types of assessment methods that address different needs while having some degree of commonality. Accordingly, the CMMI product development team has defined requirements for a family of assessment methods using the ARC as the vehicle.

A particular assessment class would be defined by identifying the ARC requirements that a member of the class would need to satisfy. For example, the SCAMPI method satisfies the entire set of requirements, while other classes might satisfy a subset of the ARC requirements. The assessment method classes and their associated characteristics and requirements are described in the ARC [SEI 00a].

4 SCAMPI Tailoring Options

A full understanding of SCAMPI tailoring options is considered to be essential for users of the method. Successful application of the method relies on adjusting the parameters of the method to the specifics of the organizational unit to be assessed and the goals and constraints imposed by the assessment sponsor. This, in turn, depends on a full understanding of the underlying method requirements and the degrees of freedom permitted by the method. Some tailoring decisions involve trade-offs. Understanding the costs and benefits of such trade-off decisions helps to ensure that assessment expectations are met.

The discussion of tailoring options is structured around the highest impact decisions that need to be made to apply the method to a specific assessment. Additional tailoring options exist but are considered to be of secondary interest to an assessment sponsor.

Many of the tailoring options are interdependent; a choice in one dimension induces a choice or limits options in one or more other dimensions. One of the responsibilities of the SCAMPI Lead Assessor is to help the assessment sponsor work through the set of tailoring decisions to ensure that the choices made are consistent with and support the sponsor's goals for the assessment.

The sponsor's goals for the assessment largely influence most of the significant tailoring options. Therefore, it is imperative that the assessment goals and the role of the assessment in the larger context of the business environment be understood and articulated in the assessment plan.

4.1 CMMI Model Scope

There is a strong relationship between the number of processes to be investigated and the cost and duration of the assessment. The broader the range of processes to be examined by the assessment, the higher the cost and the longer the duration of the assessment. The range of processes to be examined depends, in turn, on the sponsor's objectives.

Tightly coupled with the process scope determination is the matter of ratings. If an assessment objective is to determine the maturity level of an organization then the set of processes to be examined is largely pre-determined.

4.2 CMMI Model Representation

If individual process area capability ratings are desired then the continuous representation should be employed. The flexibility available through use of the continuous representation brings with it the responsibility to select meaningful combinations of process areas.

4.3 Assessment Team Size

The minimum *required* assessment team size for the SCAMPI method is 4 team members. The maximum *recommended* size is 10 team members. Issues that affect the choice of team size include the scope of the assessment (both model and organizational) as well as the diversity of skill sets and experience required to perform an effective examination of the assessed organization's engineering and management activities.

A minimum of one member of the assessment team must be from the organizational unit being assessed, and more than one is recommended.

4.4 Organizational Scope

For assessment purposes, the term *organizational unit* is defined as that part of an organization that is the subject of an assessment. This unit is the scope of the organization to which one can reliably attribute the results of the assessment.

An organizational unit deploys one or more processes that have a coherent process context and operates within a coherent set of business goals. An organizational unit is typically part of a larger organization, although in a small organization, the organizational unit may be the entire organization. In general, a shared management structure or funding chain can typically be identified in such an organizational unit. This is important to ensure that improvement recommendations resulting from the assessment are supported effectively.

An organizational unit may be, for example, any of the following:

- a specific project or set of (related) projects
- a unit within an organization focused on a specific life-cycle phase (or phases) such as acquisition, development, maintenance, or support
- a part of an organization responsible for all aspects of a particular product or product set

In determining the organizational scope of the assessment the following factors are relevant to consider:

- The discipline(s) to be assessed
- The process scope of the assessment
- The extent of the organization the sponsor desires the assessment to examine

- The number of process instances the assessment will examine

The discipline scope of the assessment influences which parts of the organization need to be considered for inclusion in the assessment. Focusing on the systems engineering discipline results in the inclusion of those parts of the organization responsible for systems engineering functions; similarly, focusing on the software engineering discipline results in the inclusion of those parts of the organization responsible for software engineering functions.

The process scope of the assessment influences which parts of the organization need to be considered for inclusion in the assessment based on the roles and responsibilities encompassed by the process areas to be investigated.

The extent of the organization the sponsor desires the assessment to examine influences which parts of the organization need to be considered for inclusion in the assessment based on business goals and other considerations not directly related to the assessment method itself.

The number of process instances the assessment examines influences which parts of the organization need to be considered for inclusion in the assessment because the assessment team must be able to gather enough data to provide an acceptable level of confidence in the assessment results.

4.5 15504 Process Profile Option

SCAMPI is designed to provide for 15504 conformance as a natural consequence of its execution. There are, however, two 15504-related considerations that may impact the design of a particular assessment. If a 15504 process profile is desired by the assessment sponsor then:

- The CMMI model scope may be impacted so that the desired 15504 processes can be profiled following the assessment.
- A follow-on activity must be planned to derive the 15504 profile from the assessment record using the SCAMPI 15504 translation mechanism.

4.6 Other Options

This category of options is presented since they can have a non-trivial impact on one or more important performance attributes of the assessment.

4.6.1 Interviews

The number and duration of interviews can be adjusted upwards from the minimum recommended. This will increase the cost and duration of the assessment but will also increase confidence in the final assessment results as well as increase the organization's acceptance of the results of the assessment.

The number of assessment participants can be increased (in terms of number of questionnaire respondents or interviewees per session) upwards from the minimum recommended. This will increase the cost of the assessment but will also increase confidence in the final assessment results as well as increase the organization's acceptance of the results of the assessment.

5 Time Frame and Personnel Requirements

To help identify the resources that are needed to perform an assessment, this section provides a typical assessment time frame and discusses who needs to be involved.

5.1 Assessment Time Frame

A typical assessment time frame is shown in Table 2.

Task	When Performed
Planning the assessment and training the assessment team	Months 1-2
Conducting the assessment	Month 3
Developing the action plan	Months 4-5
Implementing the action plan	Months 6-24
Conducting the reassessment	Months 18-24

Table 2 Typical Assessment Time Frame

5.2 Personnel Resource Requirements

The personnel resources required during the conduct of a SCAMPI assessment can vary considerably. In particular, the discipline(s) selected and the model scope of the assessment has a significant impact on resource requirements.

For example, a focused assessment might be conducted to examine in depth one or two process areas using the continuous representation. Such an assessment would have resource requirements at the low end of the spectrum of possibilities. In contrast, an assessment encompassing the full range of process areas (either staged or continuous) would have a correspondingly higher resource demand.

The numbers in Table 3 may be used as preliminary guidelines in planning the personnel requirements for an assessment. These figures are based on experience with source model assessments as well as early CMMI pilot assessments. The figures in Table 3 should be considered broad estimates for the personnel required, and do not include overtime. These figures will tend to define the upper boundaries for assessments encompassing one or two disciplines and a full model scope.

Usage data and experience from CMMI pilot assessments will be an important factor in considering refinements to the SCAMPI method. Likewise, as more pilot data is gathered the estimates provided in Table 3 will be refined.

Phase & Task	Person Designated to Perform Task	Effort Required
Phase One: Plan and Prepare the Assessment	Assessment team leader Sponsor Organizational unit coordinator	10 days 3 days 10 days
Completing Pre-Onsite Activities	Assessment team leader Organizational unit coordinator Assessment team members Questionnaire respondents	5 days 5 days 5 days each 5 days each
Phase Two: Conduct the Assessment	Assessment team leader Sponsor Organizational unit coordinator Assessment team members Assessment participants (project leaders, middle managers, and functional area representatives)	10 days 4 hours 5 days 10 days each 4 hours each
Phase Three: Report Results Follow-on Activities	Assessment team leader Sponsor Organizational unit coordinator Assessment team members	5 days 1 day 5 days 1 day each
Totals for All Phases	Assessment team leader Sponsor Organizational unit coordinator Assessment team members Assessment participants (project leaders, middle managers, and functional area representatives)	8 days 25 days 16 days each 0.17 days each 30 days

Table 3 Personnel Resource Requirements for a SCAMPI Assessment

6 Future Improvement and Expansion of the SCAMPI Method

There are several feedback mechanisms in place to enable the continuous improvement of the SCAMPI method. The SEI requires Lead Assessors to provide feedback following each assessment that they lead. In addition, all sponsors and assessment team members are asked to provide feedback to the SEI at the conclusion of an assessment. Further, the SEI accepts change requests from anyone who wishes to submit one.

As additional disciplines are added to the CMMI Product Suite, changes and additions to SCAMPI will be made as necessary.

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Appendix A History of Source Appraisal Methods

Process is defined to mean the set of activities, methods, and practices that guide people (with their tools) in the production of a product [Dunaway 96b]. It has become widely accepted that the quality of a system is largely governed by the quality of the process used to develop and maintain it [Crosby 79, Deming 86, Humphrey 90, Juran 88].

A.1 EIA/IS 731 Systems Engineering Appraisal Method

In October of 1992, the INCOSE (International Council of Systems Engineering) formed the Capability Assessment Working Group (CAWG). The CAWG charter included developing “a method for assessing and improving the efficiency and effectiveness of systems engineering,” and one of its goals was to develop a Systems Engineering Capability Assessment Model (SECAM). Generation of the INCOSE SECAM began in November of 1993 and was completed as an initial release, Version 1.00, in February of 1994. Version 1.00 of the SECAM Assessment Method (then called Supporting Documents) was released in March of 1994. The INCOSE SECAM and SECAM Assessment Method have since been updated. The current release of the INCOSE SECAM is Version 1.50, dated June 1996. The current release of the SECAM Assessment Method is Version 1.50, dated July 1997.

In January of 1994, the Enterprise Process Improvement Collaboration (EPIC), then called Industrial Collaboration, began generating the CMM for Systems Engineering (SE-CMM) and completed it as an initial release, Version 1.0, in December of 1994. Version 1.0 of the SE-CMM Appraisal Method was released in June of 1995. Both the SE-CMM and SE-CMM Appraisal Method have since been updated. The current release of the EPIC SE-CMM is Version 1.1, dated November 1995. The current release of the SE-CMM Appraisal Method is Version 1.5, dated June 1996.

In March of 1996, an effort was initiated under the auspices of the EIA G-47 (Systems Engineering) Committee to merge the current versions of the INCOSE SECAM and its Assessment Method with the current versions of the EPIC SE-CMM and its appraisal method. The resulting EIA Systems Engineering Capability Model (SECM) and SECM Appraisal Method has become an interim U.S. national standard for the measurement and improvement of systems engineering capability [EIA 98a].

The Systems Engineering Appraisal Method [EIA 98b] was developed and documented in 1997 to support appraisals against the SECM reference model. Although the basic concepts in the appraisal method are adaptable to most organizational appraisal contexts, the method is designed specifically to focus on rating the capability of individual processes. The appraisal method activities are the same the basic set as that used by the CBA-IPI method for staged architecture CMMs, developed by the SEI. However, some differences exist due to the continuous architecture of the SECM.

The EIA IS 731-2 Appraisal Method was developed by the same EIA G47 SECM Working Group that developed the EIA/IS 731, Part 1. This method is designed to compare an organization's System Engineering capabilities against the specific practices of the focus areas and the generic characteristics defined in the EIA/IS 731, Part 1. The SECM Working Group developed this method to reduce the barriers to enterprise-wide process improvement [EIA 98b].

A.2 CMM-Based Appraisal for Internal Process Improvement (CBA IPI)

In accordance with the mission of the SEI to provide leadership in advancing the state of the practice of software engineering, the SEI has emphasized treating software development tasks as processes that can be defined, practiced, measured, and improved. In early software process publications, a software maturity framework and questionnaire [Humphrey 87] were developed to help organizations characterize the current state of their software practices, set goals for process improvement, and set priorities.

Beginning in early 1987, the SEI developed and refined an approach to software process assessment, named the Software Process Assessment (SPA) method, which built on experience gained from programming site studies conducted at a number of IBM development centers in the early 1980s [Radice 85]. This method was used for SEI-assisted assessments and self-assessments during the period from 1987 to 1994 [Kitson 89, Olson 89] and was the basis for the first two SEI reports on the state of practice of software engineering [Humphrey 89, Kitson 92].

The SEI commercialized the SPA method in 1990. Industry and government licensees were selected as vendors to market assessment services. Based on the success and widespread use of the maturity framework and software process assessments, Version 1.0 of the SW-CMM was published in 1991 [Paulk 91a, Paulk 91b]. In 1993 the SW-CMM was revised, and Version 1.1 was published [Paulk 93a, Paulk 93b].

The CBA IPI method was developed and field-tested in 1994. After factoring in lessons learned from community feedback, the SEI released CBA IPI V1.0 in May of 1995. The method and documentation were upgraded to V1.1 in March of 1996 [Dunaway 96a]. The method explicitly uses SW-CMM V1.1 as a reference model. The CBA IPI was designed to

establish consistency among SW-CMM-based assessments so that results from one assessment can be compared to those of another.

A.3 Features Extracted for the SCAMPI Method

Features of the CBA IPI and the EIA/IS 731 Appraisal Method were considered in the development of the SCAMPI method. Appendix B provides a comparison of key features of the two source models. One of the driving forces in selecting SCAMPI features⁷ was the requirement that the SCAMPI method be a Class A method, thus satisfying all of the ARC V1.0 requirements. Independent of the source from which features were extracted, the key objective has been to achieve a reasonable balance between confidence in the assessment findings (including ratings) and overall assessment cost. For the SCAMPI, accuracy and rigor take precedence over cost and duration considerations. Assessment sponsors desiring a less rigorous (and potentially less accurate) method and/or a less costly method should consider Class B or Class C approaches.

The EIA Appraisal documentation states: “The appraisal method activities are the same basic set used by the SEI CMM-Based Appraisal for Internal Process Improvement (CBA IPI) method for staged architecture CMMs. Some differences exist due to the different model architectures”[EIA98b]. Although there are many similarities among the assessment activities between the two methods, some of the most significant differences include those discussed in sections A.3.1 to A.3.10.

A.3.1 Questionnaires

CBA IPI: The maturity questionnaire used in the CBA IPI contains, for each key process area, one question per goal and one question for each of the institutionalization common features. Although it is permissible to use questionnaire responses to corroborate other data sources, it is not encouraged for questionnaire responses to corroborate documentation. Interview questions are needed to validate that the assessment is not done only by examining paper artifacts without talking to the people who are doing the work.

EIA/IS 731-2: The questionnaire used in the EIA/IS 731 contains one question per practice. Questionnaire responses are used along with documents to focus interview questioning down to the key issues.

The SCAMPI method provides for the use of a questionnaire. Although the caveat remains of not doing an assessment solely from paper artifacts, the use of questionnaire responses with documentation is meant to reduce the number of questions that need to be asked in interviews.

⁷ Features of the CBA IPI and the EIA/IS 731 Appraisal Method were considered in the development of the SCAMPI method. Appendix B provides a comparison of key features of the two source models.

A.3.2 Corroboration of Data

CBA IPI: For an observation to be considered corroborated, all of the following must be true:

- It must be based on data from at least two independent sources (e.g., a document and an interview session, or two different interview sessions).
- It must be based on data obtained during at least two different data gathering sessions.
- At least one of the two data sources must reflect work actually being done (e.g., interviews of people performing the related work or review of implementation-level work products).

EIA/IS 731-2: The rules of corroborating data are not addressed explicitly. However, corroboration rules are inherently built in to the appraisal method. The first corroboration activity is to compare the responses of project leads to the questionnaire. Any answer other than “yes” is investigated through exploratory interview questions and/or documentation review. The case of only one respondent saying “yes” (and lacking evidence to the contrary) would result in a practice being evaluated as “not satisfied.”

The ARC requirements allow a questionnaire response to be corroborated by a document. Since SCAMPI is designed to be a Class A assessment method, it uses this criterion for corroboration of data.

A.3.3 Review of an Organization’s Process Documentation

CBA IPI: At a minimum, documentation is required and reviewed for each goal within the process areas and assessment scope.

EIA/IS 731-2: The use of documentation as evidence is optional.

Class A assessment methods require validation by documentation to provide confidence in the accuracy of results. As a Class A method, the SCAMPI method collects data by reviewing documentation.

A.3.4 Sufficiency of Data

CBA IPI: A practice is considered to have sufficient data coverage if the data collected are adequate to do the following:

- understand the extent of implementation of the practice
- represent the organizational units within the assessment scope
- represent the life-cycle phases in use within the assessment scope

EIA/IS 731-2: The EIA/IS 731 Appraisal Method requires the evaluation of data from multiple sources (multiple questionnaire responses as a minimum) for each practice. Multiple data

items must exist to represent multiple programs or groups to become a candidate for a finding and have organization-wide application.

The SCAMPI method uses essentially the same CBA IPI method requirement for sufficient data coverage.

A.3.5 Rating Scales

CBA IPI: Maturity level ratings are produced in integers: 1 through 5, consistent with the SW-CMM V1.1.

EIA/IS 731-2: Six levels of capability (for the organization) are provided for each process area: level 0 is the lowest; level 5 is the highest. The granularity for scoring can be selected to be whole point, half point, or quarter point.

The SCAMPI method requires that the maturity and capability level ratings be designated in integers⁸. If additional insight is desired, an assessment team may choose to show the basis upon which maturity level or capability level ratings are derived.

A.3.6 Use of Practices in the Rating Process

CBA IPI: Strengths and weaknesses are formulated for each practice from data collected. Practice weaknesses are examined in aggregate for use in rating goals. It is optional to determine whether each practice is “satisfied” or “unsatisfied.”

EIA/IS 731-2: A scoring template is completed, one focus area at a time:

- At each capability level, the number of specific practices achieved is compared to the number of specific practices at that level. Depending on the number of specific practices, a credit is established for the focus area.
- To get credit at each level, all the generic practices at that level must be achieved.
- Utility (generic attribute satisfaction) is calculated by averaging the combined responses for value and effectiveness questions for each process area, with “Marginal,” “Adequate,” “Significant,” “Measurably Significant,” and “Optimal” being awarded points.

The focus area rating is determined by the number of boxes completed (each “box” corresponds to the satisfaction of a prescribed per cent of the generic practices, specific practices, and generic attributes) on the scoring template. Scores may be presented as whole numbers, on a half-point scale (0.5, 1, 1.5, 2...) or a quarter-point scale (0.25, 0.5, 0.75, 1, 1.25...). The level of granularity will affect the scoring process, since it determines if and how “partial credit” will be indicated.

⁸ There is no consensus in the assessment community on the utility of fractional maturity or capability level ratings.

The SCAMPI method provides the option of rating practices as “satisfied” or “unsatisfied.” However, there is no automatic roll-up of the practice ratings to indicate goal ratings. Since practices as a group support a goal, they are not considered to be independent of each other or of equal weight in all cases. As a result, they are considered in aggregate in goal rating.

While the goals are required model components and are the focus of rating by an assessment team, the expected and informative model components play an important role in helping to assure a common understanding of the intent of the goals. Accordingly, the goals need to be understood in the context of the entire model, not just one or two sentences comprising the goal text. A variety of model components are present to help ensure a common understanding of goal intent; these include (1) practices, (2) sub practices, (3) notes, (4) discipline amplifications, (5) generic practice elaborations and (6) glossary definitions. The SCAMPI method expects the assessors to use the entire model as the context for their deliberations.

A feature in the SCAMPI and CBA IPI methods provides for a specific practice to be “excluded from coverage” if the practice is not applicable to the organization being assessed. The team’s rationale must be documented for excluding the practice and reported to the sponsor to avoid any risk or misunderstanding in future assessments.

At the current time, generic attributes are not included in the SCAMPI method, but piloting of this EIA/IS 731 feature is ongoing.

A.3.7 Rating of Process Areas

CBA IPI: A process area is satisfied if all of its goals are satisfied. A process area is unsatisfied if any one of its goals is unsatisfied. An optional provision exists for a process area to be “partially satisfied” if at least one goal is satisfied; however, this is represented as “unsatisfied” relative to a maturity level rating.

EIA/IS 731-2: The EIA/IS 731 and the predecessor SE-CMM use a percent of practices as criteria for rating specific practices. Full-point, half-point, and quarter-point scales are used for scoring. A process area is given a capability level rating for the organization being appraised.

The SCAMPI method rates process areas according to their goal satisfaction.

A.3.8 Rating of Maturity Levels

CBA IPI: All process areas within a maturity level must be satisfied or not applicable to claim a maturity level as well as all process areas within maturity levels below the level being claimed.

EIA/IS 731-2: Maturity levels are not addressed in the normative parts of the EIA/IS 731 Appraisal Method.

The SCAMPI method provides for rating maturity levels using either model representation. For the staged representation, all process areas within a maturity level must be satisfied or not applicable to achieve a maturity level (as well as all process areas within maturity levels below the level being claimed.) For the continuous representation, an equivalent staging may be used to convert process area capability level ratings into a maturity level.

A.3.9 Qualifications of Assessment Team Leader

CBA IPI: The assessment team leader shall satisfy the following qualification criteria:

- have authorization in good standing in the SEI Appraiser Program that provides training to qualified persons, authorizes the use of CMM assessment material, and monitors the use of such material
- have training and experience using the reference model
- have training and experience using the assessment method
- have experience in delivering training, managing teams, facilitating group discussions, and making presentations

EIA/IS 731-2: No requirements are established for the assessment team leader qualifications.

The requirements for qualification as a SCAMPI assessment team leader are summarized in Appendix E. Provision is made for the recognition of individuals with team leader experience using existing assessment methods, such as the EIA/IS 731 and CAF-compliant methods. These experienced individuals may be able to bypass certain provisions of the SCAMPI qualification requirements described in Appendix E.

A.3.10 Responsibilities of Assessment Team Leader

CBA IPI: The assessment team leader must ensure that each assessment team member:

- satisfies the team member selection criteria
- receives training at least equivalent to the 3-day Introduction to the CMMI course developed by the SEI
- receives assessment team training (2.5 to 3 days of training) for effective implementation of the assessment method

EIA/IS 731-2: A two- to eight-hour briefing is recommended to provide team building, review the model, and review the appraisal method. Although it is not necessary for all members of the appraisal team to be thoroughly versed in the concepts of organizational appraisal, the appraisal will proceed more smoothly and be likely to produce better results, if at least one (preferably two) of the appraisal team members is skilled in the facilitator role for organizational appraisals. Annex E is provided as training support materials and summarizes the steps of the onsite period.

The SCAMPI method places responsibility for assuring that assessment team members meet the team selection criteria on the SCAMPI Lead Assessor. The team member selection requirements are of the same nature as for CBA IPI.

Appendix B Comparison of Source Appraisal Methods

This appendix compares the CBA IPI V1.1 and the EIA/IS 731-2 Appraisal Method V1.0 relative to the ARC V1.0 requirements.

ARC V1.0 requirements	CBA IPI V1.1 Documentation (Lead Assessor's Guide V1.1, March 1996)	EIA/IS 731-2 Appraisal Method V1.0 Documentation (January 20, 1998)
<p>4.3.2 The method shall provide for the development of an assessment plan that, at a minimum, identifies ...</p> <ul style="list-style-type: none"> • assessment scope • the CMMI models (version, discipline, and representation [e.g., staged or continuous]) used • ... • mechanisms <i>to be used to ensure the confidentiality of assessment data and associated sources.</i> 	<p>Part 2 – Activity P-1 and P-2 provide for identifying the reference model scope for the assessment.</p> <p>The assessment plan must include a confidentiality agreement that describes the minimum required mechanisms to be employed. (See the work aid Confidentiality Agreement.)</p>	<p>EIA/IS 731-2 section 2.2.2 provides for identifying the scope of the reference model for the assessment.</p> <p>Confidentiality rules are referenced in the appraisal process description and defined in Annex D - Appraisal Method Training Support.</p>
<p>4.5.3 The method shall require a mechanism for validating each accurate observation according to the following criteria:</p> <ul style="list-style-type: none"> • The observation is corroborated. <p>[4.5.4 The method shall require the following minimum set of criteria to</p>	<p>Rules of corroboration require that each observation is</p> <ul style="list-style-type: none"> • based on data from at least two independent sources, (e.g., a document and an interview session, or two different interview sessions), and • based on data obtained 	<p>The EIA/IS 731 Appraisal Method requires multiple positive responses to questions on practices to obtain credit for the practices. Optionally, discrepancies may be resolved through interviews, feedback sessions, or documentation review.</p>

ARC V1.0 requirements	CBA IPI V1.1 Documentation (Lead Assessor's Guide V1.1, March 1996)	EIA/IS 731-2 Appraisal Method V1.0 Documentation (January 20, 1998)
<p>be satisfied in order for an observation to be considered "corroborated":</p> <ul style="list-style-type: none"> • The observation is based on data from at least two different sources (e.g., the data should originate from at least two different individuals). • The observation is based on data from at least two different data-gathering sessions. • At least one of the two data points must reflect work actually being done (e.g., process area implementation).] • The observation is consistent with other validated observations (e.g., validated observations cannot be both true and mutually inconsistent; in aggregate, they constitute a set of truths about the organization unit which must be consistent). 	<p>during at least two different data gathering sessions, and</p> <ul style="list-style-type: none"> • at least one of the two data sources must reflect work actually being done (e.g., interview of someone enacting a practice, or review of implementation-level work products). <p>Consistent with other validated observations.</p>	<p>Not addressed</p>
<p>4.5.5 The method shall require a mechanism for determining that sufficient data has been collected to cover the scope of the assessment, according to the following minimum set of rules:</p> <ul style="list-style-type: none"> • A specific or generic practice has sufficient data coverage if validated observations ex- 	<p>Each practice within the assessment scope is required to have sufficient data coverage. A practice is considered to have sufficient data coverage if the data collected are adequate to: a) understand the extent of implementation of the practice, b) represent the organizational units within the assessment scope, and</p>	<p>The required questionnaire insures that multiple data items are collected on the performance of each practice. This, taken with the data collected from multiple feedback sessions and interviews, is considered sufficient. Multiple stickies (individual observations on the performance of practices) must exist to represent multiple programs or groups to become a candidate</p>

ARC V1.0 requirements	CBA IPI V1.1 Documentation (Lead Assessor's Guide V1.1, March 1996)	EIA/IS 731-2 Appraisal Method V1.0 Documentation (January 20, 1998)
<p>ist for the practice and</p> <ol style="list-style-type: none"> 1. are adequate to understand the extent of implementation of the practice 2. are representative of the organizational unit 3. are representative of the life-cycle phases in use within the organizational unit <ul style="list-style-type: none"> • In a staged representation, a process area has sufficient data coverage if all of its specific and generic practices have sufficient data coverage. • In a continuous representation, a process area has sufficient data coverage if all of its specific practices and the generic practices within the assessment scope have sufficient data coverage up through the capability <p>level being investigated for the process area (e.g., the target capability level).</p>	<p>c) represent the life-cycle phases in use within the assessment scope.</p>	<p>for a finding and have organization-wide application. The required data coverage is built in by requiring a questionnaire response on every practice, from multiple sources.</p>
<p>4.6.2 The method shall require that maturity level ratings and/or capability level ratings be based on the CMMI measurement frameworks for maturity</p>	<p>Maturity level ratings are produced in integers: 1 through 5, consistent with the SW-CMM V1.1.</p>	<p>EIA/IS 731 provides for six levels of capability for each process area for the organization being appraised: Level 0 is the lowest; Level 5 is the highest. Section 4.1.10 pro-</p>

ARC V1.0 requirements	CBA IPI V1.1 Documentation (Lead Assessor's Guide V1.1, March 1996)	EIA/IS 731-2 Appraisal Method V1.0 Documentation (January 20, 1998)
and capability defined for CMMI models.		vides that granularity for scoring can be selected to be whole point, half point, or quarter point.
4.5.1 The method shall require assessment team consensus in decisions when determining the validity of observations, creating findings, and establishing ratings.	Ratings are determined by the consensus judgment of the assessment team.	Section 4.1.10 and Section 6.8 specify that ratings be based on the degree to which the appraised entity performs all of the requirements at a given level, in the judgment of the appraisal team.
<p>4.6.3 The method shall rate each specific and generic goal (provided the prerequisites of rating have been completed) within the assessment scope in accordance with the following rules:</p> <ul style="list-style-type: none"> Rate the goal “satisfied” if the associated findings indicate that, in the judgment of the assessment team, there are no significant weaknesses that negatively impact the achievement of the goal. <p>Rate the goal “unsatisfied” if the associated findings indicate that, in the judgment of the assessment team, there are significant weaknesses in the appraised entity’s satisfaction of this goal.</p>	<p>A goal is rated “satisfied” if each of the practices or alternative practices that map to the goal are implemented, and the aggregation of weaknesses, if any, do not have a significant negative impact on achievement of the goal.</p> <p>A goal is rated “unsatisfied” if one or more of the practices or alternative practices that map to the goal are not implemented adequately, and the aggregation of weaknesses have a significant negative impact on achievement of the goal.</p>	<p>Each specific practice is rated. There are no goals in the EIA/IS 731 model. Specific practices are rated “satisfied” if 80 % of the projects perform the practice consistently – with exceptions allowed for projects that have not had an opportunity, such as life-cycle phase.</p> <p>Rate the practice “unsatisfied” if not performed consistently by 80% of the projects.</p>

ARC V1.0 requirements	CBA IPI V1.1 Documentation (Lead Assessor's Guide V1.1, March 1996)	EIA/IS 731-2 Appraisal Method V1.0 Documentation (January 20, 1998)
<p>4.6.4 The method shall rate each process area within the assessment scope in accordance with the following rules:</p> <ul style="list-style-type: none"> • For a staged representation, the process area is “satisfied” if and only if all of its specific and generic goals are rated “satisfied.” • For a continuous representation, the process area is given a capability level rating based upon the highest level and all levels below for which its specific goals and the generic goals within the assessment scope have been satisfied. • When a process area is determined to be outside of the organizational unit’s scope of work, the process area is designated as “not applicable” and is not rated. • When a process area is outside of the assessment scope or if the associated findings do not meet the method’s defined criteria for data coverage, the process area is designated as “not rated” and is not rated. 	<p>A process area is rated “satisfied” if all of the goals of the process area are rated as “satisfied.”</p> <p>Not applicable</p> <p>A process area is designated as “not applicable” when the process area is outside of the organization’s scope of work.</p> <p>A process area is designated as “not rated” when either insufficient data is available to determine satisfaction, or the process area is outside of the assessment scope.</p>	<p>Not applicable</p> <p>With respect to defined criteria for data coverage – if a process area is in scope (included in the appraisal), the focus area (process area) is rated to the level the practices are satisfied according to the scoring rules.</p> <p>Appraisal Tailoring, including selecting the focus areas (process areas) to be appraised, is addressed in EIA/IS 731 Section 2.2.2.</p> <p>Not explicitly addressed.</p>

<p>4.6.5 The method shall rate maturity level, when desired by the assessment sponsor, in accordance with the following rules:</p> <ul style="list-style-type: none"> • A maturity level for a staged representation is achieved if all process areas within a level and within each lower level are either “satisfied” or “not applicable.” • A maturity level for a continuous representation is achieved if the capability level profile is at or above the target profile for that maturity level in the equivalent staging 	<p>In order to achieve a particular maturity level, all of the process areas within that level and all levels below that level must be satisfied or determined to be not applicable.</p> <p>Not applicable</p>	<p>The EIA/IS 731 model does not provide for maturity levels. The only mention of maturity levels is an error in the (informative) Annex E.</p> <p>Not applicable</p> <p>Annex E discusses maturity ratings, but does so in an informative (not normative) Annex and is considered an error by the EIA/IS 731 authors.</p>
<p>4.2.6 The method documentation shall provide guidance for an assessment team leader’s qualification criteria including</p> <ul style="list-style-type: none"> • training and experience using the assessment reference model • training and experience using the assessment method • experience in delivering 	<p>Required to take the three-day Introduction to CMM course developed by the SEI prior to attending CBA Lead Assessor Training. Also requires prior experience as an assessment team member on two assessments.</p> <p>Required to acquire prior experience as an assessment team member on two assessments. Required to successfully complete CBA IPI Lead Assessor training developed and provided by the SEI.</p>	<p>No provision exists for an assessment team leader’s qualifications. Section 1.2.1 provides that the “appraisal method makes heavy use of informal knowledge that practitioners provide.</p> <p>Although it is not necessary for all members of the appraisal team to be versed thoroughly in the concepts of organizational appraisal, the appraisal will proceed more smoothly, and is likely to produce better results, if at least one, and preferably two, of the appraisal team members are skilled in the facilitator role for organizational appraisals. The facilitators are included as members of the appraisal team.</p>

<p>training, managing teams, facilitating group discussions, and making presentations</p>	<p>Required for a CBA IPI</p> <p>Note that, in addition to the above, an assessment team leader must be authorized and in good standing in the SEI Lead Assessor Program.</p>	
<p>4.1.2 The assessment team leader shall</p> <ul style="list-style-type: none"> a) Ensure that the assessment is conducted in accordance with the method's documented process. b) Confirm the sponsor's commitment to proceed with the assessment. c) Ensure that assessment participants are briefed on the purpose, scope, and approach of the assessment. d) Ensure that he/she has adequate training and knowledge to interpret the assessment reference model. e) Ensure that all of the assessment team members have the appropriate prerequisite knowledge and skills. f) Ensure that all of the assessment team members have formal training or equivalent experience in the use of the assessment 	<p>Team member selection criteria are provided by the CBA IPI method.</p> <p>Assessment team members are required to have at least the equivalent of the three-day Introduction to the</p>	<p>Although it is not necessary for all members of the appraisal team to be versed thoroughly in the concepts of organizational appraisal, the appraisal will proceed more smoothly, and is likely to produce better results, if at least one, and preferably two, of the appraisal team members are skilled in the facilitator role for organizational appraisals.</p>

<p>reference model.</p> <p>g) Provide assessment team training to ensure that assessment team members have the necessary knowledge and skills to perform the method, the necessary competence to use instruments or tools chosen to support the assessment, and access to documented guidance on how to perform the defined assessment activities.</p> <ul style="list-style-type: none"> • Verify and document that the assessment method requirements have been met on completion of the assessment. 	<p>CMMI course developed by the SEI prior to receiving assessment team training.</p> <p>Assessment Team Training materials are provided to Lead Assessors in order for them to provide a 2.5- to 3-day training session to their assessment team members.</p> <p>Lead Assessors must complete a Requirements Checklist to determine that all method requirements have been met.</p>	<p>Both model and appraisal team training should be conducted during the first half-day of onsite activities in a two- to eight-hour briefing.</p> <p>See above</p> <p>Not addressed</p>
<p>4.7.3 The method shall report assessment data to the CMMI Steward, or its designee, for the purpose of reporting aggregated assessment information to the constituent community. At a minimum, the assessment data includes the assessment record.</p>	<p>Lead Assessors are required to return assessment results to the SEI.</p>	<p>Not addressed</p>

Appendix C Glossary

At this time the ARC glossary and the CMMI-SE/SW [SEI 00b, SEI 00c] glossary provide the basis for terminology in the SCAMPI Method Description document. It may become necessary in the future to introduce SCAMPI-specific terms in this document. In that case, they will be defined here. For the convenience of readers, the ARC glossary has been reproduced here in its entirety; as SCAMPI-specific terms are added in the future, appropriate adjustments in the presentation of this material will be made so that the scope of the terms remain clearly defined.

accurate observation	An observation extracted from data collected during an assessment that has been determined by the assessment team to be: a) worded appropriately, b) based on information seen or heard, c) relevant to the assessment reference model being used, d) significant such that it can be classified as a strength, weakness, or alternative practice, and e) not redundant with other observations.
alternative practice	A practice that is a substitute for one or more practices contained in the CMMI model that achieves an equivalent effect toward satisfying the goal associated with the practice(s).
assessment	An examination of one or more processes by a trained team of professionals using an assessment reference model as the basis for determining strengths and weaknesses. An assessment is typically conducted in the context of process improvement or capability evaluation.
assessment class	A family of assessment methods that satisfies a defined subset of requirements in the Assessment Requirements for CMMI (ARC). These classes are defined so as to align with typical usage modes of assessment.

assessment finding	The results of an assessment that identify the most important issues, problems, or opportunities for process improvement within the assessment scope. Assessment findings are inferences drawn from validated observations.
assessment input	The collection of information required before a process assessment can commence.
assessment objectives	The desired outcome(s) of an assessment process.
assessment participants	Members of the organizational unit who participate in providing information during the assessment.
assessment rating	The value assigned by an assessment team to (1) a CMMI goal or process area, (2) the capability level of a process area, or (3) the maturity level of an organizational unit. The rating is determined by enacting the defined rating process for the assessment method being employed.
assessment reference model	The CMMI model to which an assessment team correlates process activities.
assessment scope	The definition of the boundaries of the assessment encompassing the organizational limits, the CMMI model limits, and the context within which the processes to be investigated operate.
assessment sponsor	The individual who authorizes an assessment, defines its goals and constraints, and commits to the use of the final findings for process improvement.
assessment team leader	A person who leads the activities of an assessment.
capability evaluation	An assessment by a trained team of professionals used as a discriminator to select suppliers for contract monitoring and incentives. Evaluations are used to gain insight into the process capability of a supplier organization and are intended to help decision makers make better acquisition decisions, improve subcontractor performance, and pro-

vide insight to a purchasing organization (e.g., Software Capability Evaluation [SEC] V3.0).

CMMI appraisal questionnaire (CAE)	A set of questions about practices and goals in each process area of the assessment reference model. Depending on the ARC-compliant appraisal method being used, the CMMI Appraisal Questionnaire response summaries may provide assessors with guidance for scripting questions for interviews, help in identifying documents for review, provide information for use in crafting observations and findings, serve as an independent source of data for the corroboration of observations, or be used to support model training.
CMMI measurement framework	The definition of process capability levels and maturity levels in the CMMI Product Suite.
consensus	A method of decision making that allows team members to develop a common basis of understanding and develop general agreement concerning a decision.
consolidation	The activity of collecting and summarizing the information provided into a manageable set of data, to determine the extent to which the data are corroborated and cover the areas being investigated, to determine the data's sufficiency for making judgments, and to revise the data-gathering plan as necessary to achieve this sufficiency.
corroboration	The extent to which enough data has been gathered to confirm that an observation is acceptable for use by an assessment team.
coverage	The extent to which data gathered addresses the scope of an assessment.
coverage criteria	The specific criteria that must be satisfied for coverage to be claimed.
data collection session	A team activity during which information that will later be used as the basis for observation formulation or corroboration is gathered. Data collection sessions (or activities) include the administration and/or analysis of questionnaires, document review, interviews, and presentations.

document	A collection of data, regardless of the medium on which it is recorded, that generally has permanence and can be read by humans or machines.
draft findings	Findings created by an assessment team after consolidating and synthesizing valid observations to present the findings to the assessment participants for validation of accuracy.
final findings	The findings derived during assessment activities and presented to the sponsor.
findings	The conclusions of an assessment, evaluation, audit, or review that identify the most important issues, problems, or opportunities within the assessment scope. Examples of findings are strengths, weaknesses, and validated observations.
instruments	Artifacts used in an assessment for the collection and presentation of data (e.g., questionnaires, organizational unit information packets).
interviews	A meeting of the assessment team members with assessment participants for the purpose of gathering information relative to work processes in place.
Lead Assessor	A person who has demonstrated the necessary skills, competencies, and experience for leading a process assessment.
objective evidence	Qualitative or quantitative information, records, or statements of fact pertaining to the characteristics of an item or service or to the existence and implementation of a process element, which is based on observation, measurement, or test and which can be verified. [ISO 94]
observation	A written record that represents the assessment team members' understanding of information either seen or heard during assessment-data-collection activities. The written record may take the form of a statement or may take alternative forms as long as the information content is preserved.

organizational scope	See “organizational unit.”
organizational unit	That part of an organization that is the subject of an assessment. An organizational unit deploys one or more processes that have a coherent process context and operates within a coherent set of business goals. An organizational unit is typically part of a larger organization, although in a small organization, the organizational unit may be the whole organization. An organizational unit may be, for example: (a) a specific project or set of (related) projects; (b) a unit within an organization focused on a specific life-cycle phase (or phases) such as acquisition, development, maintenance, or support; (c) a part of an organization responsible for all aspects of a particular product or product set.
process	A sequence of steps performed for a given purpose, for example, the software development process. A set of activities, methods, and practices that guide people (with their tools) in the production of a product.
process context	The set of factors, documented in the assessment plan, that influence the judgment and comparability of assessment ratings; these include, but are not limited to: the size of the organizational unit to be assessed; the demographics of the organizational unit; the application discipline of the products or services; the size, criticality, and complexity of the products or services; and the quality characteristics of the products or services.
satisfied	Rating given to a goal when the associated findings indicate that, in the judgment of the assessment team, there are no significant weaknesses that negatively impact the achievement of the goal. Rating given to a process area when all of its goals are rated “satisfied.”
strength	As used in CMMI assessment materials, implementation of practices which, in the judgment of the assessment team, contribute to the satisfaction of a goal. Strengths related to CMMI models are effective implementations of one or more of the CMMI model practices or alternative practices.

sufficient data coverage

The coverage requirements have been met. See “coverage” and “coverage criteria.”

tailoring

Selection of options within the assessment method for use in a specific instance, making the method suitable for a specific application. The intent of tailoring is to assist an organization in aligning the application of the method and model with its business objectives.

valid observation

An observation that the assessment team members agree is a) accurate, b) corroborated, and c) consistent with other validated observations.

weakness

The ineffective implementation of, or lack of, practices which, in the judgment of the assessment team, detract from or interfere with achievement of a goal.

Appendix D SEI Appraiser Program

[The following information is current as of Sept. 28, 2000.]

The SEI Appraiser Program is designed to maintain community confidence in the application of appraisal technology within the community of disciplines encompassed by maturity models. The goals of the program are to do the following:

- maximize the value and use of selected process appraisal methods, which are designed and facilitated by qualified, trained individuals, as part of a systematic discipline-focused improvement program
- transition appraisal technology to clients in an effective manner, maintaining consistency and quality in the process

The SEI strives to ensure the continued confidence of the software and systems engineering community in the quality of its process appraisal technologies. The SEI Appraiser Program selects and trains the highest quality candidates to lead appraisals. Persons meeting the requirements of the program have credentials that distinguish them. They have access to SEI appraisal methods, training materials, technical support, and upgrade training.

Through their participation in appraisals and through feedback mechanisms built into appraisal methodologies, they participate in the advancement of appraisal technologies. Lead Assessors and Lead Evaluators are required to return appraisal results to the SEI upon completion of the appraisals. These results are entered into the Process Appraisal Information System (PAIS) database from which profile data are reported in industry aggregates two times a year and reported via the SEI Web site.

The SEI Appraiser Program encompasses several tracks representing different practice-based process models. Lead Assessors qualified to lead CMMI-based SCAMPI assessments will be part of the SCAMPI Lead Assessor Track.

SCAMPI Lead Assessors will be qualified to lead CMMI-based assessments regardless of the discipline or representation. They will be skilled in conducting and leading the assessment method. If they are leading an assessment outside of their discipline expertise, the assessment team members will be selected to cover the discipline adequately.

In order to bootstrap an initial group of SCAMPI Lead Assessors from both the systems engineering community and the software engineering community, consideration will be given

(through 2001) to persons experienced in leading assessments in these discipline areas who can demonstrate equivalence in meeting certain of the requirements for SEI-authorized SCAMPI Lead Assessors. Equivalence may be established in the following areas: (1) CMMI model experience, (2) experience as an assessment team member, (3) lead assessor training, and (4) successful observation leading an assessment. Equivalence determination will be performed by a designated governing body according to equivalence criteria provided by the SEI.

D.1 SCAMPI Lead Assessor Authorization Process

SCAMPI Lead Assessors are authorized to deliver SCAMPI assessment services; this includes helping organizations plan and prepare for a SCAMPI assessment, building and training the assessment team and leading the team through the assessment process, including the presentation of assessment results to the assessment sponsor. They are authorized to use SEI-provided SCAMPI materials during the conduct of SCAMPI assessments.

The documented process and criteria for an applicant to become authorized as a SCAMPI Lead Assessor in the SEI Appraiser Program are fully documented on the SEI Web site at <<http://www.sei.cmu.edu/managing/appraiser.listing.html>>. The essential elements of the authorization process are summarized below.

The authorization process consists of the following:

- acceptance of the applicant's organization as an SEI Transition Partner,
- admission to the SCAMPI Lead Assessor Track,
- successful completion of SCAMPI Lead Assessor Training,
- successful completion of the observation process.

Step 1: Applicant's Organization Becomes an SEI Transition Partner

The applicant's organization becomes an SEI Transition Partner for SCAMPI assessment services; this enables the organization to recommend individuals for admission to the SCAMPI Lead Assessor track.

Step 2: Admission to the SCAMPI Lead Assessor Track

SCAMPI Lead Assessor applications are reviewed by the SEI; acceptance as a Candidate SCAMPI Lead Assessor is based on the applicant's satisfaction of the selection criteria, which are highlighted below:

The applicant has training, experience, and competence in the following areas:

1. training knowledge and experience

2. process-improvement skills
3. instructional skills
4. interpersonal skills

The applicant has successfully completed the Introduction to CMMI course.

The applicant has successfully completed the Intermediate CMMI Model Training course.

The applicant must have at least ten years work experience in software engineering or systems engineering⁹ including at least two years of experience in managing technical personnel.

The applicant must have a Master's degree in a relevant technical area (such as systems engineering or software engineering).

The applicant must have experience as an assessment team member within the prior 24 months on at least two SCAMPI assessments¹⁰.

Applicants who successfully complete the application step will receive written confirmation from the SEI that will allow them to register for SCAMPI Lead Assessor Training.

Step 3: SCAMPI Lead Assessor Training

Registered applicants will attend SCAMPI Lead Assessor Training offered by the SEI.

After successfully completing the training, an applicant is considered to be a Candidate Lead Assessor.

Step 4: Observation Process

To successfully complete the observation process, a Candidate Lead Assessor must be observed by a qualified Observing SCAMPI Lead Assessor while leading a SCAMPI assessment.

D.2 Responsibilities of Lead Assessors

SCAMPI Lead Assessors have the following responsibilities:

- Conduct SCAMPI assessments in accordance with (1) the provisions of the SCAMPI method and related documentation (including, but not limited to this document and the Assessment Requirements for CMMI (ARC)), (2) SCAMPI Lead Assessor Training, and any additional requirements communicated to SCAMPI Lead Assessors by the SEI.
- Conduct SCAMPI Team Training for assessment teams being led by the authorized SCAMPI Lead Assessor; no public offerings of SCAMPI Team Training are permitted.

⁹ As other disciplines are added to the CMMI Product Suite, this requirement will be adjusted as appropriate.

¹⁰ Participation in SCAMPI assessments will be verified on the Process Appraisal Information System (PAIS).

- Participate in at least two SCAMPI assessments within each 24-month authorization period. One of these two assessments may be as an assessment team member; however, at least one must be as the assessment team leader.
- File a complete assessment report with the SEI Appraiser Program within 30 days of completion of each SCAMPI assessment led.
- Obtain and use current SEI-provided SCAMPI materials.
- Complete any required upgrade courses and examinations successfully; accept and use upgraded materials when available.
- Cooperate in randomly selected audits of assessments by the SEI and take any recommended remedial action as a result of the audit.

Appendix E CMMI Project Participants

The following people were involved in the CMMI project as product development team members, steering group members, or members of the stakeholder/reviewer team.

Ahern, Dennis	Denny, Barbara	Jarzombek, Joe
Albert, Cecilia	DeWolf, Barton	Johnson, Martha
Allgood, Bruce	Doran, Terry	Jones, Lawrence
Angstadt, Kim	Draper, Geoff	Kansala, Kari
Armstrong, Jim	DuBlanica, Walt	Karandikar, Harsh
Austin, Darryl	Dulai, Ajmel	Kayuha, Bob
Bailey, Mike	Dunaway, Donna	Keeler, Kristi
Baker, Michele	Dutton, Jeffrey L.	Kellner, Marc
Barsotti, Dennis	Dzmura, Lucas	Kellogg, David
Basili, Victor	Eagan, Robert	Kelly, Susanne
Bate, Roger	Egeland, Jim	Kirschbaum, Alan
Baxter, Brent	El-Emam, Khaled	Kitson, Dave
Bennett, Dan	Eskenasy, Antonio	Kitson, Loretta J.
Beshore, Dave	Fantazier, Bob	Kohl, Ron
Billi, Joseph	Farinello, Joe	Konrad, Mike
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13. ABSTRACT (MAXIMUM 200 WORDS) <p>This document provides a high-level overview of the Standard CMMISM Assessment Method for Process Improvement (SCAMPISM). The depth of information provided is suitable for a number of audiences, including potential sponsors of assessments, senior technical advisors, and individuals who may be assessment participants. This document explains the role of assessments in the context of the IDEALSM (Initiating, Diagnosing, Establishing, Acting, Leveraging) approach to software process improvement.</p> <p>This document is not intended to provide in-depth information on how to conduct a SCAMPI assessment, perform detailed planning for an assessment, or train an assessment team. Those wishing to conduct a SCAMPI assessment in their organization should contact an SEI-authorized SCAMPI Lead AssessorSM to ensure that the assessment is performed by a trained, qualified individual who will conduct the assessment for the maximum benefit of the assessed organization. A list of SEI-authorized SCAMPI Lead Assessors is maintained on the SEI's Web pages at http://www.sei.cmu.edu/managing/appraiser.listing.html.</p> <p>The SCAMPI method is based on the CMM[®]-Based Appraisal for Internal Process Improvement (CBA IPI) V1.1 assessment method [Dunaway 96b] and the Electronic Industries Alliance/Interim Standard (EIA/IS) 731.2 Appraisal Method [EIA 98b]. SCAMPI satisfies the Assessment Requirements for CMMI (ARC) V1.0 [SEI 00] and is a Class A assessment method.</p> <p>The SCAMPI method is a diagnostic tool that supports, enables, and encourages an organization's commitment to process improvement. The method helps an organization gain insight into its process capability or organizational maturity by identifying strengths and weaknesses of its current processes relative to one or more of the CMMI models, including the Capability Maturity Model[®]-Integrated for Systems Engineering and Software Engineering (CMMI-SE/SW).</p> <p>The SEI, as steward of the CMMI Product Suite, works to assure that any public comments or statements about maturity levels or ratings resulting from a SCAMPI meet quality and consistency criteria.</p> <p>In this document, brief descriptions of method activities are provided with a discussion of tailoring options. Guidelines are provided for establishing resource requirements for conducting a SCAMPI assessment. The SEI Appraiser Program is discussed, detailing the qualifications required to become an SEI-authorized SCAMPI Lead Assessor. Interested parties should refer to the SEI Web site for complete and current information on the SCAMPI authorization process.</p>				
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