Technical Report
CMU/SEI-89-TR-7
ESD-89-TR-7

Conducting SEI-Assisted Software Process Assessments

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FOR THE COMMANDER

(signature on file)

Thomas R. Miller, Lt Col, USAF, SEI Joint Program Office

This work is sponsored by the U.S. Department of Defense.

Abstract: This report describes software process assessment as it is performed in organizations with the assistance of the Software Engineering Institute (SEI). A software process assessment is an appraisal or review of an organization's software process (e.g., software development process). The main objectives of such an assessment are to understand the state of practice in an organization, to identify key areas for improvement, and to initiate the actions that facilitate those improvements. This report is specifically addressed to the organizations and assessment team members that may be involved in an SEI-assisted software process assessment.

1. Introduction

1.1. Software Process Assessment

Process is defined, in the most general sense, as a set of actions, tasks, and procedures that when performed or executed obtain a specific goal or objective. More specifically, a software process is a process to develop, maintain, support, or enhance software. An example of a software process is a software development process. A software process assessment is an appraisal or review of an organization's software process.

The SEI has developed and is currently refining a methodology for assessing software process. The main objectives of assessments are to understand the state of practice of the software process in an organization, to identify key areas for improvement, and to initiate actions that facilitate those improvements. The purpose of this report is to give a descriptive overview of SEI-assisted software process assessments. SEI-assisted assessments are those in which the SEI provides consulting and is directly involved with an organization in performing the assessment.

The SEI assessment methodology uses a software process maturity framework and a maturity questionnaire. The next three sections give a brief overview of the software process maturity framework, the maturity questionnaire, and contexts for using the questionnaire. The reports referenced in these sections (and the assessment training) provide additional, more detailed information.

1.2. Software Process Maturity Framework

A software process maturity framework was developed by the SEI for two purposes: to provide the Department of Defense (DoD) with a means of characterizing the software process, and to help determine and improve the capabilities of software development organizations (see reference [18]). The maturity framework provides the basis for the assessment. It helps identify the state of an organization's software process, helps provide a vision of the desired process, and serves as a mechanism for establishing priorities for software process improvement. The framework is intended for use with a software process assessment methodology, which includes the maturity questionnaire described in the next section.

The SEI has defined five levels of software process maturity:

1. **Initial** -- at the initial process level, an organization can be characterized as having ad hoc, or possibly chaotic, process. Typical problems at this level are cost and schedule overruns, lack of formal procedures, and little or no change control.
2. **Repeatable** -- the organization has achieved a stable process with a repeatable level of control by initiating rigorous project management of commitments, costs, schedule, and changes. The repeatable level has achieved rudimentary predictability of schedules and costs, project management, basic software configuration management (change control), and basic software quality assurance. A major problem at the repeatable level is that the software process is not yet completely defined or recorded.

3. **Defined** -- the organization has defined the software process as a basis for consistent implementation and better understanding. At this point, advanced technology can be introduced to improve the process. Software engineering process groups (SEPG) that focus on improving the software process evolve at this level.
4. **Managed** -- the organization has initiated comprehensive software process measurements; analysis and significant quality improvements are generally made. At the managed level, statistical process control can be applied to analyze and improve the software process.
5. **Optimizing** -- the organization now has a foundation for continued improvement and optimization of the software process. At the optimizing level, an organization is in a position to apply statistical process control to maximize the use of technology, increase productivity, and improve product quality. There is also a basis for quantitative feedback on the software process, so defect prevention can take place.

1.3. Maturity Questionnaire

The maturity questionnaire [16] was designed in conjunction with the software process maturity framework. The SEI developed this questionnaire as a tool for the assessment team. It contains a structured set of yes/no questions, with each question relating to a specific software process maturity level in the framework.

The questionnaire is used during an assessment to do the following:

- Provide a detailed framework for identifying key issues for discussion later in the assessment.
- Narrow the focus of the assessment team to selected key areas, and help the team to focus on areas most important to the organization.
- Identify areas about which to request supporting information.
- Quickly establish an initial reading of an organization's software process maturity level.

The maturity questionnaire is used as a "springboard" to start the assessment in the right direction. The experience and judgment of a trained assessment team determines the software process maturity level and identifies major software issues of an organization. Thus, it is not appropriate to use the questionnaire as a stand-alone tool for an assessment.

1.4. Contexts for Using the Maturity Questionnaire

There are currently four contexts in which the maturity questionnaire is used. Two of these involve assessments:

- **SEI-assisted assessments**: software process assessments conducted by a trained team of software professionals from both the SEI and the organization being assessed. The scope of an SEI-assisted assessment is usually a section or division of an organization or possibly an entire site (one location of an organization).
- **Self-assessment**: software process assessments conducted at an organization by a trained team of software professionals within that organization. The scope of the

self-assessment may be a division of an organization, an organizational site, or the entire organization. Self-assessments provide a way for an organization to examine its own software process and monitor progress toward software process improvement. The SEI trains in-house assessment teams to conduct self-assessments of their organization.

In addition, the questionnaire is used in these two contexts:

- **Software capability evaluations**: These are evaluations conducted as part of the Department of Defense software acquisition process. They may also be used by software organizations to evaluate subcontractors. A software capability evaluation is applied to site(s) where the proposed effort will be performed. The method is a subset of an assessment; an evaluation team concentrates on substantiating questionnaire responses. The SEI does not perform evaluations, but it does offer training in conducting software capability evaluations.
- **Assessment workshops**: At workshops, conferences, tutorials, and symposiums, the SEI describes software process assessments, software capability evaluations, and the assessment methodology. These events also enable the SEI to receive feedback on the quality of the maturity questionnaire and to gather industry-profile data from the questionnaire.

The scope of this report is limited to the first context, SEI-assisted assessments. The following sections discuss assessment objectives and provide an overview and schedule for the SEI-assisted assessment process.

1.5. Assessment Objectives

The main objectives of assessments are the following:

- Determine the current state of the software process that is practiced on a day-to-day basis in an organization.
- Identify key areas for software process improvement. These are the few high-priority areas on which an organization should focus improvement efforts.
- Start the changes needed for software process improvement within an organization by enrolling key software practitioners and technical leaders in the change process.
- Help an organization focus on monitoring and improving its software process.
- Identify good work (e.g., tools, methods, techniques) being done by the representative projects so that the organization as a whole can benefit.

1.6. Overview of the Assessment Process

SEI-assisted assessments are typically conducted in six phases. Each assessment phase is addressed in a separate chapter in this report (Chapters 3-8).

1. **Selection Phase**: During the first phase, an organization is identified as a candidate for assessment (see Chapter 3). The SEI contacts the organization to set up an executive level-briefing (see Section 4.1).
2. **Commitment Phase**: In the second phase, the organization commits to the full

assessment process (see Chapter 4). An assessment agreement (see Appendix A) is signed by senior representatives of the organization and the SEI. This commitment includes the personal participation of the senior site manager, site representation on the assessment team, and agreement to take action on the assessment recommendations.

3. **Preparation Phase**: The third phase is devoted to preparing for the on-site assessment (see Chapter 5). An assessment team, composed of members from the SEI and the organization being assessed, receives training. In addition, the on-site assessment is planned. The assessment participants are selected and briefed about the assessment process, including times, duration, and purpose of their participation. The questionnaire can also be filled out at this time. An example of an assessment team training agenda is in Appendix B.

4. **Assessment Phase**: In the fourth phase, the on-site assessment is conducted (see Chapter 6). On the first day, senior management and assessment participants are briefed as a group about the objectives and activities of the assessment. The project representatives complete the questionnaire if they have not done so previously. The resulting data and information is reviewed and analyzed by the assessment team. The team then holds discussions with each project. On the second day, the team conducts discussions with the functional area representatives or key software practitioners, who provide further insight into the software process. Over the course of the third day, the assessment team formulates findings based upon the information that has been collected on the previous days and gets feedback from the project representatives. On the last day, the findings are reviewed with the project representatives to help ensure that the assessment team understands the issues correctly. The findings are revised, if necessary, and presented to the assessment participants and senior site management. The assessment ends with formulation of the recommendations that address the findings. An example of an on-site assessment agenda is in Appendix C.

5. **Report Phase**: The fifth phase is concerned with the final formulation and communication of assessment findings and specific recommendations that address those findings (see Chapter 7). The assessment team prepares a formal written report, which is given to the organization along with a formal recommendations presentation (see Section 7.4).

6. **Assessment Follow-Up Phase**: In the final phase, an action team composed entirely of professionals from the assessed organization is assembled and charged with formulating an action plan and facilitating its implementation (see Chapter 8). Typically, there is also some continuing support and guidance from the SEI. After approximately eighteen months, a reassessment or self-assessment is done by the organization to determine progress and to continue the software process improvement cycle.

1.7. Schedule of Assessment Events

Assessments and software process improvement are a tremendous amount of work. There is much to do in a short amount of time. While every assessment is different, they follow the same general schedule. After the selection phase, a typical schedule of events looks like this:

Month 1 -- executive-level briefing and signed assessment agreement between SEI and the organization to be assessed

Month 2 -- half-day pre-assessment team training presentation with readings

Month 3 -- two-day assessment team training

Month 4 -- four-day on-site assessment

Month 5 -- report on assessment findings and recommendations

After receiving the final report, the organization spends three to six months developing an action plan. Implementation and the software process improvement effort begin when the plan is approved by senior management. Eighteen months later, the organization may be ready to conduct a self-assessment to evaluate progress and determine its new software process maturity status.

2. Assessment Principles

Assessments are a challenging activity. Time is short; organizations are complex; and the software process tends to be personnel-intensive in nature. In order to meet these challenges, the SEI has developed the principles described in this section. They are the keys to conducting a successful assessment:

- Sponsorship
- Confidentiality
- Teamwork
- Action orientation
- Software process framework

2.1. Sponsorship

A sponsor is an individual or group that authorizes the assessment and assumes final responsibility for it. The sponsor ensures that the assessment has legitimate backing and that software process improvement has official support and financial guarantees.

The sponsor is usually the senior site manager--the person who sets the operational priorities for the organization. To be an effective sponsor, this person must give high priority and strong support to the assessment and software process improvement. The sponsorship role involves the following:

- Providing authorization and support for the assessment, a responsibility which cannot be delegated.
- Being visible and personally involved in the assessment and follow-up activities.
- Assigning the resources and qualified people for planning and implementing the assessment and follow-up activities.
- Building sustaining sponsorship through middle management.
- Educating oneself and sustaining sponsors in the assessment process and software process improvement. This understanding helps sponsors make the decisions necessary to support improvement activities and secure the critical resources needed.
- Agreeing to and signing the assessment agreement.

2.2. Confidentiality

The power of an assessment is that it taps the knowledge and skills of the organization's software experts and project leaders (assessment participants). Their accounts of the software process as it is practiced at the organization influence the results of the assessment. Because assessments depend upon the honest, open, and accurate information that comes from the assessment participants, it is vital that they feel that they can speak in confidence.

Confidentiality is needed at all organizational levels. No leaks can occur--not to others in the organization, their bosses, or the organization's chief executive. In addition, it is important to note that an assessment is not an audit or mechanism used to single out specific individuals or projects as having unique problems; an assessment is done for the benefit of the organization.

Senior management must sponsor and agree to these notions of confidentiality prior to the assessment so that team members are not compromised by pressures to divulge confidential information. A vehicle used to communicate these principles and help obtain the support of management is the assessment agreement (see Appendix A).

Assessments build confidentiality by several means:

- Composite assessment team findings
    - individuals are not named
    - projects are treated as a group--five to six projects are reviewed at one time
- An assessment agreement that has confidentiality provisions built in
- An assessment team training program and assessment presentations that teach confidentiality guidelines

While many people agree to confidentiality in principle, it is difficult to enforce and maintain. Yet, if confidentiality is lost, the organization is at the following risks:

- Participants will be less open and provide less information.
- The assessment team will have incomplete and, therefore, less accurate information on which to base its findings and recommendations.
- The assessment is likely to fail to meet its goals and objectives.

2.3. Teamwork

A successful assessment is a collaborative effort to identify present good practice and key areas for improvement. Teamwork occurs on several levels: within the assessment team; between the team and assessment participants; and between those involved in the assessment and the rest of the organization.

One strength of the assessment process is that it is conducted as a structured study by a team of knowledgeable and experienced professionals. Team members from the organization and the SEI each make a valuable contribution. The site team members understand the organization's software process and organizational culture; and the SEI members add an independent professional viewpoint to the assessment. The training they receive together, including team-building exercises, helps them to form an effective and efficient assessment team.

Assessments are based on the assumption that local software experts are in the best position to understand the organization's software process issues. With the leading in-house professionals contributing their knowledge and skills, the assessment can be a catalyst to motivate the entire organization to self-improvement. Thus, the assessment team learns during its training the im-

portance of listening; team members guard against assuming they understand the problems before participants fully discuss them. Similarly, early briefings for participants encourage the view of assessments as a cooperative effort focused on learning and understanding. In addition, participants become aware that their contribution can help to change (and improve) the organization's software process.

There must be sufficient rapport between the team and the organization's key people so the latter will share their problems, concerns, and creative ideas. (See references [7], [23], and [27] for related information.)

2.4. Action Orientation

Assessments are actually preludes to action; they are mechanisms to enable the beginning of the change process. An organization which chooses to participate in an assessment must be directed toward software process improvement.

Assessment findings focus on identifying problems that are key software process issues currently facing the organization. Improvement goals and expectations are set as a result of conducting an assessment. There is a risk: if no improvement actions are subsequently taken, the assessment may have a negative effect on the current situation. In the past, the local practitioners could assume that management did not entirely understand the issues and, thus, could not be expected to address them. After the assessment, this is clearly not the case. Senior management receives a written report that describes the current state of the practice, identifies key areas needing improvement, and lists a set of recommendations. If management does not then take action, the morale of the software professionals will suffer. An organization must be prepared to take action, or it should not conduct an assessment.

2.5. Software Process Framework

An assessment implies that there exists a standard or framework to measure against: an organization's software process needs to be reviewed in comparison with some vision of how software processes should be performed. Without this standard or framework, an assessment can easily become a loosely directed intuitive exploration. With the framework, there is a basis for orderly exploration as well as a means for establishing improvement priorities. The framework gives the team a focus for working together on the key issues and recommendations.

The assessment methodology described in this report uses such a framework. The SEI technical report, *Characterizing the Software Process: A Maturity Framework* [18], describes the software process maturity framework in detail.

3. Selecting Candidate Organizations for SEI-Assisted Assessments

To better understand the criteria for selecting candidate organizations for SEI-assisted assessments, it is helpful to be aware of the objectives and goals of the SEI for conducting the assessments. These are:

- Demonstrate the feasibility and value of conducting assessments as a means of improving the software process in the DoD community.
- Facilitate software process improvement in key software organizations.
- Increase SEI knowledge of current important software issues and practices.

The SEI performs approximately six SEI-assisted assessments each year. The following guidelines are used in making selection decisions.

- The SEI considers:
    1. DoD priorities and needs.
    2. The level of activity and affiliation between the SEI and the organization.
    3. The extent to which the assessment and the data collected will be of value to the SEI.
    4. The level of commitment of the organization's management to the terms of the assessment agreement (see Appendix A).
- The SEI avoids participating in assessments that involve software projects in the competitive phase of a procurement.
- If all criteria are equally satisfied by more than one organization, the assessments are conducted on a first-come, first-served basis.

4. Committing to the Assessment

4.1. Executive-Level Briefing

After an organization has been selected for an SEI-assisted assessment, a member of the SEI technical staff visits the organization to give an executive-level briefing to the senior site manager and his or her immediate staff. The main topics of discussion for this briefing are:

- An overview of the SEI
- The objectives and benefits of an assessment
- An overview of software process management and software process improvement concepts
- The software process maturity framework
- An overview of the assessment process

After the briefing, the organization can make a commitment to an SEI-assisted assessment by signing the assessment agreement. The next step is to select the assessment team members and the organization's assessment coordinator. The following sections discuss the assessment agreement and assessment team selection.

4.2. The Assessment Agreement

The assessment agreement is a written agreement between the SEI and the organization (for detailed terms and conditions, see Appendix A). This agreement states that senior management will sponsor the assessment by providing the commitment and resources necessary--not only to conduct the assessment but also to carry out the assessment team's recommendations in an organizational action plan. The agreement, thus, formally communicates to the sponsor the extent of support needed to conduct and follow up an assessment.

In addition to identifying and outlining sponsorship, the document represents an agreement between the organization's senior management, the assessment team, and the assessment participants. It communicates specific information, such as:

- The scope of the assessment (particular site or division)
- Assessment activities, such as SEI training, the participant briefing, the findings presentation, the final report, and the action plan
- Confidentiality provisions
- Selection of the assessment team, assessment participants, and projects

The assessment agreement is signed by the senior site manager and all assessment team members.

4.3. Assessment Team

Careful selection of the assessment team can help ensure that the assessment is conducted in a proper and thorough manner, that assessment principles are upheld, and assessment participants feel comfortable enough to contribute fully to the assessment. The following sections discuss the roles and characteristics of assessment team members.

4.3.1. Assessment Team Roles

In an SEI-assisted assessment, the assessment team consists of an assessment team leader, an SEI assessment coordinator, and five to eight assessment team members--two or three from the organization and three to five from the SEI. Experience has shown that assessment teams of five to ten members seem to work well. Larger teams can be hard to manage and are generally less productive. A site assessment coordinator works with the assessment team. The team leader and SEI coordinator always have previous SEI-assisted assessment experience; and usually two of the SEI members, including the leader, have performed at least two assessments. It is preferred, but not necessary, that the site coordinator also be a member of the assessment team.

The roles are as follows:

Assessment team leader (member of the SEI technical staff) -- This person is charged with ensuring that the assessment is conducted in a proper and productive manner. He or she leads most of the discussions during the assessment and also makes the formal presentations, including assessment team training presentations, the introductory management presentations at the on-site assessment, and the assessment findings presentation to senior management. This person should have experience both in leading teams and in making public presentations. The leader works closely with the SEI assessment coordinator.

SEI assessment coordinator (member of the SEI technical staff) -- The SEI assessment coordinator is in charge of the assessment logistics. Responsibilities include assisting the site assessment coordinator; working with the assessment team leader; preparing, coordinating, and conducting the assessment team training; and preparing for the on-site assessment. The SEI coordinator also brings to the assessment all materials required during the on-site period.

Site assessment coordinator (site professional) -- The site coordinator is in charge of all the assessment logistics for the organization; this person works with the SEI assessment coordinator. The site coordinator does not need any previous assessment experience.

Assessment team members -- (site professionals and SEI technical staff) All team members attend the assessment team training at the SEI and the on-site assessment. Each member also writes a portion of the assessment final report and participates in a final report review at the SEI.

4.3.2. Criteria for Selecting the Assessment Team

@level4[Essential characteristics]

Site assessment team members should be all of the following:

- Very knowledgeable about the organization.
- Well respected within the organization.
- Motivated to improve the organization's software process.
- Willing to accept change and have the ability to help implement change (be a change advocate or change agent).
- Sensitive to people and able to address questions to assessment participants in a clear and non-threatening way.
- Capable of making a positive contribution as assessment team members.

Team members should be opinion leaders--other people listen to what they have to say--and team players as well.

Preferably, members should have at least 8-10 years' experience as software professionals.

@level4[Restrictions]

Site assessment team members should not occupy positions within the organization that may lead to a conflict between the assessment principles and their job function (for example, if assessment participants believe that information they volunteer has the potential to affect them adversely after the assessment, they may not speak freely or not speak at all). Nor should there be a conflict between their function on the assessment team and their regular job function. To help ensure a free flow of information, organization assessment team members should not hold positions that involve any of the following activities:

- Acting as manager of a project included in the assessment, nor the manager of such a person.
- Working on or being directly involved with reviewing or supporting a project being assessed.
- Currently serving in a software audit or software quality assurance (SQA) position for any of the projects being reviewed.

4.3.3. Time Commitments of Team Members

Dedicated participation is essential during assessment team training, the on-site assessment, and the review of the final report. During these meetings, phone calls are held, all other meetings and commitments are rescheduled, and the members are required to be on time to every assessment session. Elimination of outside interruptions allows the assessment to proceed smoothly.

Listed below are estimates of the time a team member will need for assessment activities.

- Pre-assessment team training presentation for all team members, held on-site (see Section 5.1): one-half day.
- Review of reading materials provided at the pre-assessment team training presentation (see Section 5.1): several days.
- Assessment team training session for all team members, held at the SEI (see Section 5.2): two days, plus travel and preparation time.
- Preparation by the site assessment coordinator for the on-site assessment (see Chapter 5): 25%-30% of that person's time for about a month--from the end of the assessment team training to the beginning of the on-site assessment.
- The on-site assessment, which involves all team members (see Chapter 6): four full days.
- Participation of each team member in writing a portion of the final report during the week following the assessment (see Chapter 7): two to three days.
- Final report review by all team members, held at the SEI approximately three weeks after the assessment (see Section 7.2): one day, plus travel and preparation time.

After the assessment, the site team members may become members of an action plan team (see Chapter 8) or a software engineering process group (see Section 8.4).

5. Preparing for the Assessment

This chapter discusses the pre-assessment activities that set the stage for a smooth and orderly on-site assessment.

5.1. Pre-Assessment Team Training

After the organization has committed to the assessment and has selected its assessment team members, the SEI assessment team leader or the coordinator visit the organization to give a half-day presentation to the site team members. The main objectives of the pre-assessment training presentation are: set realistic expectations and accurately describe the commitments needed for the assessment; answer questions; and hand out technical papers and other information. The presenter brings an advance preparation notebook for each site assessment team member. The notebooks include the following:

- SEI overview. This section is an overview of the SEI mission and technical programs.
- Readings on software process management.
- Assessment process overview (see Section 5.2.1).
- SEI-assisted assessment preparation. This section includes an overview of the advance preparation materials, the organizational briefing, information about project selection, and the assessment schedules.
- Maturity questionnaire overview (see Section 1.3). This section includes the report, *A Method for Assessing the Software Engineering Capability of Contractors* [16].
- Readings on managing technological change.

At the end of the presentation, the organization's team members know what they need to do before coming to the SEI for training:

- Read the material in the advance preparation notebook.
- Identify a number of candidate projects, a subset of which will be selected by the team to participate in the assessment.
- Prepare an organizational briefing to be given at the assessment team training.

5.1.1. Project Selection Criteria

After the pre-assessment team training presentation, the organization (usually the site assessment team members, with the approval of management) chooses 10 to 12 key projects as candidates for the assessment. During the on-site planning portion of the training, the assessment team as a group selects 5 or 6 of these projects along with 2 others as backup projects. Backup projects are needed in case one of the projects selected cannot participate in the assessment.

The projects should be selected using the criteria listed below.

- The project should be representative of the software of most concern to the organization.
- The project should be representative of the software process used in the organization as a whole.
- The project should have a staff of at least four members and a life cycle span of at least six months.
- The project manager should support participation in the assessment. (The project manager should not be forced to participate.)
- The projects selected should be in varying software development phases (such as requirements, design, implementation, testing, maintenance). In other words, the projects should not all be in the same phase.
- There should be a mix of projects of varying duration and size.
- The projects must not be in the competitive phase of a procurement process.
- A project should not be included if an assessment team member participates in or manages it.

An important issue to remember is that the findings of an assessment are composite across the projects. Choosing a project whose process differs drastically from the others may make it difficult to generate composite findings. This might occur if the projects are from different sections or divisions whose organizational structures dictate different software development processes.

5.1.2. Organizational Briefing

The site assessment coordinator, with the help of other site team members, presents information about the organization at the assessment team training. The purpose of this briefing is to give SEI team members a good understanding of the organization and the types of software it develops. Typical briefing information includes:

- A recent organizational chart. SQA, tool groups, metrics, software engineering process groups, etc., should be pointed out. The projects being considered should also be pointed out, with an explanation of how they fit into the organization.
- The types of software systems developed or maintained.
- The total number of software professionals in the organization.
- Any internal software policies/standards.
- Information about the software engineering environment and organizational culture.

5.2. Assessment Team Training Overview

All assessment team members participate in a two-day assessment team training program at the SEI, not only to familiarize them with the assessment activities, but also to build a cohesive team. The assessment team leader and the SEI coordinator conduct the training session, which is discussed in the next section.

The training allows the team members to do the following:

- Walk through the assessment process.
- Simulate parts of an actual assessment and obtain some hands-on experience.
- Fill out the maturity questionnaire and perform some data analysis.
- Participate in team-building exercises.
- Learn or review software process management concepts.

Another important activity that takes place during the training period is planning for the on-site assessment. Team members learn what needs to be done next, the purpose behind it, their role, and the dates and times of assessment activities. There is also some planning for assessment follow-up activities.

5.2.1. Assessment Team Training

A typical assessment team training session takes about two days (see Appendix B). During that time, the team is involved in the following presentations, meetings, and exercises:

- **Process management overview** -- Material dealing with process management is introduced in this session. Process management premises and principles are discussed, along with the software process maturity framework. Finally, these concepts and framework are used to characterize the software improvement process.
- **Organizational briefing** -- See Section 5.1.2
- **Assessment process overview** -- The purpose and objectives of assessments are discussed, along with their role in software process improvement. The assessment methodology is discussed in detail.
- **Maturity questionnaire** -- This session describes the maturity questionnaire, its role in the assessment, and how it is used. To obtain hands-on experience in using it, team members fill out the questionnaire on a software project with which they are familiar.
- **Review of project responses** -- During this session, the team members simulate some of the activities in an assessment. The data from the questionnaire forms are reviewed to identify similarities, differences, misunderstandings, and anomalies. "Probe areas" are then identified, where supporting materials would be requested in an actual assessment.
- **Assessment discussions** -- This presentation describes the role and objectives of the assessment discussions, and the methods used for conducting them. Functional area discussions and project discussions take place between the assessment team and the assessment participants.
- **Team-building exercises** -- These exercises help the team members learn to work together effectively.
- **Assessment findings** -- This presentation explains the role of the findings and the procedure used for their formulation. Some helpful guidelines are provided; the structure of the findings is discussed; and some sample findings are reviewed. The importance of the on-site findings presentation is also discussed.
- **Final report preparation** -- This presentation discusses the final report of the assessment team's findings and recommendations. The report format is described in detail, as well as the structure of the findings and recommendations. The entire assessment team is involved in the creation and review of the final report.

- **Planning for the assessment** -- Plans for the on-site assessment are discussed in detail. These include developing a detailed on-site schedule and daily agenda (see Appendix C), selecting the specific projects to be examined and the backup projects, and identifying the people to be interviewed and the facilities required. Since the people and facilities in most software organizations are heavily committed, significant advance notice is generally recommended.

At the end of the training, team members should be ready to participate in the upcoming assessment. But there is still much work to be done in preparation for the assessment, as discussed in the next sections.

5.3. Preparing for the On-Site Period

Much of the preparation for the on-site period is done by the site assessment coordinator, but all site team members are encouraged to participate since there is much work to be done. The following sections address the major tasks that should be performed a week or two before the on-site assessment:

- Selecting functional area representatives.
- Briefing the assessment participants to prepare them for the assessment.
- Filling out the questionnaire for each project (before or during the assessment).

5.3.1. Criteria for Selecting Functional Area Representatives

Functional area representatives are software practitioners from specific software process areas. Typically, there are five groups with four to six representatives each. Listed below is an example of how functional areas can be grouped for an assessment:

- Software quality assurance and release
- Software integration and test
- Coding and unit test
- Detailed design
- Requirements and high-level design

The role of the functional area representatives is to balance the management view presented by the project leaders with the technical view of software practitioners. The representatives participate in informal, unstructured discussions that allow them to express their professional views about issues and problems facing the organization. Functional area representatives should be actually working on software projects; they should not be staff personnel or managers. They should be widely recognized within the organization as technical experts in a functional area. Representatives should also be opinion leaders among their peers and should fully understand the confidentiality provisions.

5.3.2. Briefing the Assessment Participants

At least one week before the on-site period, all assessment participants should be briefed by the site assessment coordinator on the following:

- Assessment principles.
- Overview of the assessment.
- The detailed schedule for the on-site period, outlining the purpose, location, time, and length of each meeting, along with identifying who should attend (see Appendix C).

The pre-assessment briefing informs participants about the assessment process and enables them to plan for their involvement in the assessment, including giving their managers and colleagues an idea of the extent of their participation.

5.3.3. Filling Out the Maturity Questionnaire

The maturity questionnaire is filled out by project representatives either before or during the assessment. Instructions that describe the questionnaire and the procedures for completing it are given to the site team members during assessment team training. Filling out the questionnaire beforehand saves some valuable time during the assessment. However, participants' questions will need to be answered, and this can only be done by a trained assessment team member.

6. Conducting the Assessment

This chapter discusses the sequence of activities constituting the on-site portion of the assessment. Typically, these activities require four days to complete.

6.1. Introductory Management Meetings

The introductory management meetings include the assessment overview and the assessment participant briefing.

Assessment Overview

The assessment begins with presentations to the senior site manager, his or her immediate staff, and the assessment participants. The main objective of this presentation is to provide an overview of the assessment process and describe its relationship to software process improvement and software process management. It is vital that senior management attend this meeting to show their commitment to the assessment and their support for software process improvement (see Section 2.1).

Assessment Participant Briefing

After the assessment overview meeting, assessment participants receive further information about the assessment, including the schedule. The objectives of this meeting are to ensure that the participants' questions are answered and to confirm that they understand their role in the assessment--where they should be, when they should be there, and what is expected of them.

6.2. Questionnaire Data Analysis Session

As mentioned earlier, the questionnaire can be filled out either before or during the assessment. After the questionnaires have been completed, the assessment team meets in a private session to analyze the responses and determine the initial maturity level of the organization. Team members analyze questionnaire data for similarities, differences, anomalies, and misunderstandings; and they identify areas where questions need to be asked and supporting materials need to be requested. The session is private because confidentiality has been guaranteed to both the assessment participants and the individual projects.

Supporting materials are important for verifying that a particular question has been answered accurately. What is important here is verifying the actual practice in an organization, that is, the software process that is used on a daily basis. The assessment team is interested in what is actually being done, not what may be written in a set of manuals. For example, one question on the questionnaire may be "Are internal software design reviews conducted?" The supporting material requested may be the review action items or minutes of any design reviews conducted on the project.

Assessments, by their nature, tend to be negative because they uncover the most important software process issues or problems facing an organization. But the findings of an assessment

can also be positive, for another important objective of this session is to identify areas where good work is being done. Finding examples of good work and making them visible benefits the entire organization.

6.3. Project Discussions, Session I

After the questionnaire data has been analyzed, the assessment team meets with the project representatives, one project at a time. Meeting on a project-by-project basis maintains confidentiality among projects. The purpose of this session is to allow the team to get a sense of whether the questionnaire was filled out accurately and whether the maturity level of the projects seems accurate, to verify project differences and similarities, and to request supporting materials. The assessment team members listen to the representatives, asking questions about how the project does its day-to-day work of developing and maintaining software for the project. For example, the assessment team asks about configuration management, project management, and quality control.

Assessment Team Wrap-Up Meeting

After the project discussions, the assessment team meets alone to discuss the progress of the assessment, review initial findings, and prepare for the functional area discussions.

6.4. Functional Area Discussions

On the second day of the assessment, the team conducts discussions with software professionals from each major functional area of the organization's software process. The overall objective for this session is to enable the assessment team to learn what the software practitioners (non-management) consider the most important software engineering issues facing their functional area or the organization as a whole.

The discussions are informal sessions in which assessment participants are asked to describe how they do their work. These sessions allow the assessment team to learn the details of the actual day-to-day software practice. Managers do not attend these discussions so that software practitioners will feel more comfortable about speaking freely.

Near the end of the session, the assessment team leader asks each functional area representative a key question: "If you could change one thing to improve the quality or productivity of your work, what would it be?" The answers to this question are important because experience has shown that the people working directly with the product (software, documentation, etc.) generally have many good ideas for improvement.

Assessment Team Wrap-Up Meeting

To conclude day two, the assessment team holds a wrap-up meeting to review the day's findings, contrast and compare them to the previous day's findings, and prepare for the next day of the assessment. Considerable time is spent in this session in reaching team consensus on the preliminary findings.

6.5. Project Discussions, Session II

To begin the third day of the assessment, the assessment team again meets with the project representatives, one project at a time. The purpose of these meetings is to discuss any open issues, to review the requested supporting materials, and to discuss the assessment team's preliminary findings with the project representatives. During the meeting, more issues may come up and further discussion may be needed. The intent here is to gather additional data to support and refine the findings, and to identify any other problems or issues.

During these discussions, the team reviews examples of good work that have been provided by the project participants. During the final findings presentation, there is time set aside to describe good work found during the assessment.

6.6. Final Findings Formulation

After the project discussions are completed, the assessment team meets to formulate the findings and prepare the findings presentation. The findings represent the assessment team's view of the most important software process issues that currently face the organization. The findings are based on the maturity questionnaire responses, discussions with the assessment participants, and discussions among the assessment team members. The findings represent the starting point for formulating recommendations (see Section 6.9).

Extended and intense discussions are often required to reach a team consensus on the findings. Since there is no time scheduled the next day for continuing these discussions, this meeting often continues into the evening. (This is where the team-building exercises during the assessment team training can pay off.) Once the findings have been formulated, the team then prepares the findings presentation.

At the conclusion of the third day, the assessment team should have achieved a team consensus for the assessment findings and completed the preliminary findings presentation.

6.7. Assessment Findings Presentation

The findings presentation includes the following:

- **Scope of the assessment** -- This includes the site or division assessed, the names of the projects assessed, and the names of the functional areas that were interviewed.
- **Conduct of the assessment** -- This is a high-level discussion of the assessment, and how it went in general. All assessment participants and support staff are thanked for their time, cooperation, and assistance.
- **Composite organizational status** -- The software process maturity level of the organization is noted here. It is emphasized that the success of an organization is based on the action taken in response to recommendations, and not on a score.
- **Strengths** -- Any organizational strengths are noted here (e.g., examples of good project work).

- **Findings** -- Findings are summarized, and each finding is then discussed in detail. The consequences of each finding are pointed out, and general examples of the findings are used if appropriate.
- **Next steps** -- The steps following an assessment are discussed: the recommendations formulation, the final report, and the action plan, along with an anticipated schedule.

Assessment Team Session

On the last day of the assessment, the assessment team leader presents the findings presentation to the assessment team. The purpose of this session is to catch any errors and fine-tune the presentation.

Project Composite Feedback

Next, the assessment team leader gives a dry run of the findings presentation to all the project representatives together, along with the assessment team. The purpose of this meeting is to hear any concerns from the project representatives, get early feedback before the final findings presentation to senior management, and answer any questions.

Final Assessment Findings Presentation

Finally, the assessment team leader gives the final assessment findings presentation to the senior site manager, his or her immediate staff, and the assessment participants. The purpose of this session is to present the assessment team's view of the most important software process issues facing the organization. Because the organization's findings are a composite, confidentiality is ensured.

6.8. Senior Management Meeting

After the final findings presentation, the senior site manager, immediate staff (if desired), and the assessment team leader hold an executive meeting to discuss next steps. The purpose of this meeting is to confirm the time for the recommendations presentation and final report, discuss the importance of forming the action plan team and developing the action plan, and address any questions or concerns of management.

6.9. Recommendations Formulation

After the assessment findings presentation and the senior management meeting, there is one more on-site session: the initial formulation of the recommendations to address the findings. The purpose of this meeting is to obtain a team consensus on the recommendations to be documented in the final report (see Chapter 7) and to assign a portion of that report to each assessment team member.

Some guidelines used by the team for formulating the recommendations follow:

- Address each key finding, though there need not be a one-to-one correspondence between findings and recommendations.

- Limit the number of recommendations.
- Make the recommendations specific and concise.
- Prioritize the recommendations.
- Focus on *what* the recommendations are, not *how* they will be implemented.
- Be sensitive to how the recommendations affect organizational resources. Recommendations should be realistic enough to be accomplished.

In forming recommendations, the team should be sensitive to the impact on organization resources. Experience indicates that organizations can only handle a few high-priority issues at a time. For example, working on 20 high-priority recommendations at once is unrealistic. However, one effective solution is to put the recommendations into "priority groups." For example, if there are 10 recommendations, the highest priority recommendations (say 3) are grouped together into priority group one, which will be addressed first. Then the other recommendations are grouped as well, with each group having a priority. With ordered groupings, the action plan team has a stronger direction for planning and implementation.

At the conclusion of this meeting, the next steps are planned for the final report. The times, dates, and places for the final report review and for the recommendations presentation are determined. This is planning is necessary because there is a tremendous amount of work to be done in producing the final report (see next chapter).

7. Assessment Final Report

7.1. Overview

Following the on-site assessment phase, the assessment team prepares a final report of the assessment findings and recommendations. The purpose of the final report is to document the assessment, describe the key findings, and make specific recommendations to the organization based on those findings. The entire assessment team contributes to the creation and review of the final report.

A carefully written final report is vital since it is the only permanent record of the assessment. It is also used as a reference for the action plan formulation and execution, and for future reassessments.

A typical schedule for report preparation is as follows:

1st week after assessment: Each team member's portion of the report is due.

2nd week: Initial report review at SEI.

3rd week: Final report review at SEI.

4th week: Final report submitted to SEI Information Management for editing.

5th or 6th week: Recommendations presentation at the organization.

7.2. Reviews

Experience has shown that final report content and quality are best improved through a document review process. Typically, there are two report reviews at the SEI: an initial review by SEI assessment team members, and a final review by the entire assessment team. Two reviews are generally adequate. The organization's assessment team members are invited to the initial review, but it is often difficult (or too costly) for them to travel to the SEI twice in one month, especially immediately after the assessment.

The initial review is an informal, half-day review. For the final review, the organization's assessment team members visit the SEI for one full day. This review is more formal since the group is larger and this is the last review before the report is completed. The overall goals of the final review are to reach team consensus on the final report and to ensure that it is accurate and of high quality.

7.3. Report Structure

The final report contains the following sections:

1. **Executive Summary** -- a background of the visit, an acknowledgment of the organization's efforts, and a summary of recommendations in order of priority (or priority groups).
2. **Organizational Status** -- a brief statement of the software process maturity level that was determined by the assessment team, a brief summary of organizational strengths and good work observed, and planned improvements that were noted.
3. **Key Findings** -- the key findings of the assessment team.
4. **Recommendations** -- the assessment team's recommendations.
5. **Appendices**
    - Assessment Agreement -- a copy of the signed assessment agreement.
    - Assessment Conduct -- a brief overview of assessment methodology and process maturity model, a list of the assessment team members, a list of the projects included in the assessment, and a chronology of key events.
    - Cross-Reference -- a cross-reference of key findings and recommendations (this is useful since findings and recommendations do not always correspond one-to-one).

7.4. Recommendations Presentation

After the final report is completed, the assessment team leader gives a recommendations presentation at the organization to the senior site manager, his or her immediate staff, the organization's assessment team members, and the assessment participants. Typically, the SEI assessment coordinator and assessment team members do not return for this presentation. The main purpose of this presentation is to provide an overview of the recommendations to senior management and to deliver the final report.

The recommendations presentation usually provides a brief overview of the software process maturity framework and the assessment, summarizes the findings, and presents concise statements of the recommendations along with their benefits. In addition, next steps are discussed: the action plan formulation, the action plan review with SEI, and a reassessment in approximately eighteen months.

8. Post-Assessment Follow-Up

Although the goal of an assessment is to accurately characterize the current state of the software process that is practiced in an organization and identify the key software issues, the ultimate intent is to be the catalyst for software process improvement in the assessed organization. This chapter focuses on post-assessment activities that are effective in increasing the likelihood that software improvements will occur.

8.1. Action Plan Formulation

Following the on-site recommendations presentation, the assessed organization prepares an action plan that specifies how, when, and by whom each recommendation is to be implemented. Each action that addresses a recommendation is called an *action task*. The purpose of the action plan is to identify and plan the work effort for each action task, identify responsibility and resources, and provide a mechanism for tracking and reporting on task status. The organizational units or projects implementing the action task participate in its development and review, thus building a commitment to the change effort.

Sponsorship and commitment from senior management is critical after the assessment. In order for the action tasks to be successful, management must sponsor the action plan formulation, review, and implementation. Ideally, the senior site manager names a site assessment team member to guide the effort to develop the action plan. This person should be fully knowledgeable of the issues to be addressed; and he or she should be respected by the people who will be involved. It is a good idea to involve other leading professionals from the projects in action plan development; this not only contributes to the quality of the results, but it also facilitates acceptance of the action plan. Experience indicates that action plan development is most effective when done as a team effort involving all organizational units involved in implementation.

An action plan should be sufficiently detailed to provide a clear guide for execution; it specifies the following:

- What recommendations will be implemented (action tasks).
- What recommendations will not be implemented, and why.
- How each action task will be implemented.
- Resources (people and dollars) required to implement each action task.
- The person or people responsible for each action task.
- Action task schedules, with appropriate management review checkpoints.

The action plan should identify quarterly checkpoints for periodic management review (see Section 8.3). Only a few (one to three) action tasks should be attempted at a time. Experience indicates that organizations cannot effectively implement more than a few major changes at one time.

A timetable for staffing the action plan team should be completed within one or two months of the

on-site presentation of the final assessment report. The development of the action plan itself should be completed within three to six months of the presentation. Periodic and frequent (e.g., biweekly or monthly) senior management updates should occur until the action plan team is fully staffed and functioning. This safeguard ensures that the proper priority is given to the important job of formulating concrete improvement plans.

Incremental Approach to Large Changes

For action tasks that require major changes, the following incremental approach to change is recommended:

1. Select a pilot project for implementation.
2. Implement the action task on the pilot project.
3. Evaluate the result of the pilot change effort.
4. Revise the action task implementation plan based on feedback from the pilot project.
5. Implement the action task on a broader basis.

This gradual approach to major change efforts reduces the risk of failure, and smaller early successes can pave the way for larger successes as the effort builds momentum via acceptance and participation throughout the organization.

8.2. Action Plan Review

After the action plan is formulated, it should be reviewed in order to do the following:

- Improve the quality of the action plan.
- Provide opportunities for participation in the action plan formulation by practitioners and senior management, and to help enroll them into the change process.
- Provide a mechanism to build consensus to the action plan.
- Help to build and confirm the commitment of senior management to the action plan, as well as the resources necessary to implement it.

Three reviews are recommended; no order is implied except that a site peer review should come first:

- Site peer review
- Site senior management review
- SEI review

Site Peer Review

Key management and technical professionals from the organizational units that will implement the action plan should participate in a peer review of the plan. This review serves two purposes: 1) It gives these professionals the opportunity to provide their expertise, insight, and suggestions for improving the action plan and its subsequent implementation; and 2) By involving more profes-

sionals from the organization, the review helps facilitate the acceptance of the planned software process improvement effort.

This review culminates in a set of issues and suggestions for improving the plan. The action plan team then revises the plan, based on the guidance of the peer review.

Site Senior Management Review

Site senior management reviews the action plan by examining it from at least these perspectives:

1. Does the plan balance the need for software process improvements with the economic necessity of simultaneously producing software products?
2. Does the plan identify the appropriate level of resources (people and dollars) to implement the proposed plan? Is the time for implementing the plan realistic?
3. Are the action task checkpoints concisely identified and clearly stated?

If the action plan addresses these and other questions specific to the assessed organization, senior management gives approval to proceed with action plan implementation. If not, the plan is revised to address senior management concerns. In any case, senior management signifies its approval to proceed with implementation by committing the needed resources and personnel to the software process improvement effort.

SEI Review

The SEI review is conducted by a team of experienced, SEI software process professionals. At least one SEI assessment team member will participate in this review, as one who is familiar with the software process improvement needs of the assessed organization. The SEI team reviews the action plan, focusing on its feasibility and practicality, the potential for improving the assessed organization's software process, and the resources and schedule planned for the improvement effort. This review results in a set of issues and suggestions for improving the action plan. These are communicated to the action plan team leader in a letter from the SEI review team. This review does not constitute an approval to proceed with action plan implementation. Only the assessed organization's senior management can give this approval.

8.3. Periodic Site-Management Review

Action plan implementation formally begins when senior management approves the plan. There is a risk with assessments and the subsequent action plan preparation: after these activities are completed, only superficial and ineffective change efforts may be made to initiate software process improvement. Experience in these cases indicates that the organization will soon revert back to "business as usual," and the enthusiasm and momentum generated by the assessment and action plan preparation will dissipate. For process improvement to be successful, all organizational units need a high level of commitment, sustained change effort, and focus on improvement.

Some catalyst is required to maintain focus on the improvement process. One highly effective means is periodic management review. This is accomplished by establishing a clear set of im-

provement goals to be achieved by the time of the next assessment and defining action task checkpoints to be reached in each of the intervening quarters.

When action plan implementation begins, it is recommended that periodic management reviews be held monthly for the first quarter or until implementation gets under way and becomes more stable. Quarterly management reviews are recommended thereafter. These reviews are scheduled with senior management, and the objectives are defined in advance. The software engineering process group (see Section 8.4) conducts these reviews with senior management. These items, and perhaps others, are covered in a periodic management review:

- Resource staffing actuals against action plan staffing requirements.
- Progress to date on scheduled action task checkpoints.
- Resolution of high-priority process improvement issues.

Other items may be covered, depending on the specific needs of the assessed organization.

8.4. Software Engineering Process Group

One premise of process management is that the quality of a product is governed by the process used to produce it. The quality of the software process will not improve by itself; resources and people are needed. The software engineering process group (SEPG) is the focal point for software process improvement within a software organization. It provides a center of expertise to assist software practitioners in the organization and serves as the vehicle for organizational learning and change advocacy.

An SEPG is chartered to facilitate the definition, documentation, and improvement of the organization's software process. Its ongoing functions include:

- Performing periodic software process assessments.
- Reporting status of the software process to senior management.
- Facilitating the definition and improvement of technical and management processes.
- Facilitating the definition and maintenance of process standards.
- Establishing and maintaining a software process database.
- Initiating and providing process education and training.
- Identifying, screening, and evaluating appropriate candidate software technologies.
- Providing process consultation to software practitioners.

Once the SEPG is established, the group also actively participates in the action plan aspects of the process improvement effort by doing the following:

- Facilitating action plan development and review efforts.
- Leading and coordinating action plan implementation.
- Establishing and monitoring pilot change efforts.

- Tracking action plan implementation progress against plan.
- Conducting periodic management reviews.

Additional areas of activity may be appropriate. These will depend on the specific findings and recommendations of the assessment team. Smooth transition and coordination between the action plan team and a newly established SEPG are necessary for effective implementation of the action plan.

The SEPG is a small but dedicated resource of competent and experienced professionals. Typically, 2 to 3 percent of the size of the organization is adequate. While some personnel should be permanently assigned to the SEPG, it is useful to rotate technical and management professionals into the SEPG for two- to three-year assignments.

Note that the SEPG function is not to be confused with the SQA function, which is an audit and enforcement mechanism. The SEPG works closely with and assists software projects by providing knowledge, guidance, and consultation on software technologies, methods, practices, and tools.

8.5. SEI Consultation and Guidance

Within resource constraints, the SEI provides post-assessment consultation and guidance to an assessed organization. Typically this involves the SEI peer review, telephone consulting, ongoing affiliate relationships between the organization and the SEI, and possibly self-assessment training (see next section). The extent and nature of this involvement will be determined on an individual basis.

8.6. Self-Assessments

A software process assessment is not a one-time effort. Ongoing assessments are an important element of a continuous software process improvement effort within a software organization. Due to resource constraints, the SEI is able to assist only a limited number of organizations in conducting the organization's first software process assessment via SEI-assisted assessment as described in this document.

Organizations should generally plan to conduct a follow-up assessment approximately eighteen months after the action plan has been approved for the initial SEI-assisted assessment. This follow-up has the following purposes:

- Assess the progress that has been made.
- Establish a target for completion of the most important actions.
- Establish new priorities for continued improvement.

It is recommended that organizations use a self-assessment methodology in follow-up assessments. Self-assessments are conducted and structured in a manner similar to SEI-assisted as-

sessments. Organizations conduct them using their own resources and software experts. The SEI has developed an in-depth training course for preparing assessment teams in this self-assessment methodology. The SEI offers this training quarterly in Pittsburgh to organizations that wish to use it.

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Appendix A: Assessment Agreement

This Agreement is entered into by and between the Software Engineering Institute (SEI) and _____ (hereinafter referred to as Affiliate) with its principal office located at _____. This Agreement will be effective when executed by both parties. Its duration will be limited by the nature and scope of the undertakings set forth in the Agreement. Certain commitments will survive completion of the basic tasks set forth.

The SEI is a federally funded research and development center (FFRDC) owned and operated by Carnegie Mellon University pursuant to contract with the Department of Defense (DoD). Included in the SEI Charter is a requirement that the SEI shall establish standards of excellence for software engineering practice. In furtherance of that requirement, the SEI is conducting assessments of software engineering practice with individual companies and studying industry-wide practices of software engineering (the Assessment Program). Affiliate has a vested interest in assessing its level of software engineering practice on both an absolute and comparative basis.

Therefore the parties hereto agree as follows:

1. Affiliate agrees to participate with the SEI in an assessment of the Affiliate's software engineering practices.
2. The specific results of the Affiliate assessment shall be proprietary to Affiliate to be used by Affiliate as it chooses (with appropriate credit to the SEI) subject to the right of the SEI to use such results as hereinafter described.
3. Confidentiality is essential to the success of the SEI Assessment Program. The SEI will not release or otherwise identify the results of any organization's assessment.
4. The SEI is free to use assessment data and conclusions to be derived therefrom for statistical, analytical or reporting purposes provided that the confidentiality requirement can be honored and that the information can be used without attribution to its source either directly or by inference.
5. The SEI will not publish collective data externally unless such data is based upon information from not less than 10 different organizations.
6. The senior manager of the segment of Affiliate to be assessed will actively participate in the assessment by agreeing to be present (on mutually acceptable dates) for the opening on-site assessment briefing and the on-site review of final findings and recommendations. This level of participation is critical to the success of the project.
7. The SEI will provide four to six professionals as assessment team members.
8. The Affiliate will provide one or two professionals as assessment team members. It is expected that one of these professionals will, in addition, be assigned the following responsibilities:
    a. participate in a one or two day working session at the SEI shortly following the on-site assessment period to prepare the final assessment report.
    b. develop the organization's action plan based upon the final assessment report.
9. There will be one day of pre-assessment team training for the affiliates assessment team members.

10. There will be two days of assessment team training at the SEI for the entire assessment team.

11. The assessment by the SEI/Affiliate team at the Affiliate site will be done in three or four days.

12. Typically, three to five projects will be reviewed during the on-site assessment period. The Affiliate will ensure that none of the projects selected for review is involved in a competitive phase of a procurement during the on-site assessment period.

13. The SEI as soon as practicable thereafter will provide to Affiliate a final assessment report which will include recommended actions. The SEI does not represent any U.S. Government procurement agency; therefore, the recommendations made by the SEI are not to be construed as contractual directions or constructive changes to contracts which may exist between the Affiliate and the U.S. Government.

14. The Affiliate will within 60 days thereafter provide a review for the SEI of its action plan based on the final assessment report. The Affiliate is the sole determinant as to the extent that recommended actions are implemented through its action plan. It is expected that the review will cover the reasons for rejection of any final assessment report recommended actions not incorporated into the action plan.

15. The SEI, at its option, and with the consent of the Affiliate, may continue periodic interaction with the Affiliate during implementation of the action plan.

16. Each participating organization will be responsible for its personnel and their expenses. Each will provide to the other reasonable working space and support services for assessment team activities.

17. If Affiliate discloses identified proprietary information to the SEI, such information should be disclosed pursuant to a separate nondisclosure agreement. The execution of such agreement notwithstanding, the parties agree to respect the confidential nature of this Agreement and all exchanges of information hereunder. All confidential and proprietary information shall be treated with at least the degree of care with which each party treats its own such information.

18. When Affiliate has received an assessment report from the SEI and has in turn reviewed its action plan with the SEI, the basic assessment tasks will be complete and this Agreement will have served its primary purpose. However, any commitments which by their nature are intended to survive termination of the Agreement (such as nondisclosure) will survive.

19. This agreement shall not constitute, create, give effect to, or otherwise imply a joint venture, partnership or formal business organization of any kind. Each party to this Agreement shall act as an independent contractor and not as an agent for the other, and neither party shall have any authority to bind the other except to the extent, if any, specifically provided herein or by other written mutual agreement of the parties.

20. The SEI and Affiliate agree that they are each fully responsible for their and their employees' actions under this agreement and that they each indemnify and hold the other harmless for any such actions.

Software Engineering Institute Affiliate

By _____ By _____
Date _____ Date _____

I have read and understood, and I agree to abide by the provisions of this agreement.

Assessment Team Member Signature _____
Date _____

Appendix B: Example Assessment Team Training Schedule

Day 1

Start Time	Activity or Discussion Topic
8:45 am	Welcome & Introductions
8:50 am	Question & Answer Period
9:00 am	Team-Building Exercise
9:30 am	Process Management Overview
10:30 am	Break
10:45 am	Organizational Briefing
11:30 am	Assessment Process Overview
12:15 pm	Lunch
1:15 pm	Use of the Maturity Questionnaire
2:30 pm	Review of Project Responses
3:30 pm	Break
3:45 pm	Assessment Discussions
4:30 pm	Critique/Summary
5:00 pm	Adjourn

Day 2

8:30 am	Team-Building Exercise
10:30 am	Break
10:45 am	Assessment Findings
11:15 am	Final Report Preparation
11:45 am	Lunch
12:45 pm	Planning for On-Site Period (Projects)
2:45 pm	Break
3:00 pm	Question & Answer Period
3:45 pm	Planning for On-Site Period (Tasks)
4:30 pm	Training Session Critique
5:00 pm	Adjourn

Appendix C: Example On-Site Assessment Schedule

Day 1

Start Time	Activity or Discussion Topic
8:00 am	Assessment Overview
9:00 am	Assessment Briefing
9:30 am	Break
9:45 am	Questionnaire Data Analysis
12:00 pm	Lunch
1:00 pm	Project Discussions
6:00 pm	First Day Wrap-up

Day 2

8:00 am	Quality Assurance & Release
9:45 am	Break
10:00 am	Software Integration & Test
11:45 am	Lunch
1:00 pm	Code & Unit Test
2:45 pm	Break
3:00 pm	Requirements & Design
4:45 pm	Break
5:00 pm	Preliminary Findings & Wrap-up

Day 3

8:00 am	Project Discussions
12:00 pm	Lunch
1:00 pm	Findings Formulation
7:00 pm	Third Day Wrap-up

Day 4

7:30 am	Assessment Team Session
9:00 am	Project Composite Feedback
10:30 am	Prepare Final Findings Presentation
12:00 pm	Lunch
1:00 pm	Final Assessment Findings Presentation
3:00 pm	Senior Management Meeting
3:45 pm	Recommendations Formulation
5:00 pm	Adjourn - Assessment Completed

Appendix D: Assessment Questions and Answers

What is a software process assessment?

An appraisal or review done by a trained team of software professionals to determine the state of an organization's current software process, to determine the high-priority software process issues that face an organization, and to start the actions needed for software process improvement.

What is the difference between a software process assessment and a software capability evaluation?

The methods share the goal of facilitating lasting improvements in organizations' software process; but given how the results of the methods are used, each has different objectives. The main objective of a capability evaluation is to identify software engineering and management risks of contractors who are either bidding on a proposal or performing on contract. As in assessments, the method identifies strengths and weaknesses of an organization's current software process. In addition, capability evaluation considers the extent of an organization's software process improvement efforts. On the other hand, the main objective of an assessment is to determine the key software process issues facing an organization and start the changes needed for improvement.

What is the difference between an assessment and an audit?

Again, the major difference is in objectives. The overall objective of an audit is to independently review for compliance and adherence to some established set of criteria. The major objective of an assessment is to determine the key software process issues facing an organization and start the changes needed for improvement.

How many SEI-assisted assessments has the SEI conducted?

As of the date of this document, the SEI has conducted ten SEI-assisted assessments.

How many SEI-assisted assessments does the SEI do every year?

The SEI performs approximately six SEI-assisted assessments per year.

Do organizations pay the SEI for conducting SEI-assisted assessments?

No, not currently.

How do I go about having an SEI-assisted assessment of my organization?

Contact the SEI and request an SEI-assisted assessment. Chapter 3 of this report provides information on the selection criteria for SEI-assisted assessments. If an SEI-assisted assessment isn't possible, self-assessment training may be arranged.

Why do organizations want SEI-assisted assessments?

Most competitive organizations are interested in improving themselves. Assessments are a way to characterize the state of the software process in an organization and identify the most important software issues facing an organization, thus helping an organization focus on software process improvement.

Is the SEI restricted to DoD contractors when selecting candidates for SEI-assisted assessments?

No, the SEI is not officially restricted to selecting only DoD contractors. However, in keeping with its mission, the SEI gives primary consideration to the needs of the mission-critical computer resource (MCCR) community.

Are the results of assessments used for evaluations by the DoD?

No, the data is kept confidential in accordance with the assessment agreement. If an organization has had an assessment, it will still have to do the evaluation separately. A contractor evaluation is a separate activity from an assessment.

Does the SEI have any concrete data that supports or proves that conducting assessments actually helps software process improvement?

Current evidence seems to indicate that assessments fit into software process improvement very well. Assessments are based on the idea that an organization must know where its software process is before it can start to improve the process. However, there currently is no data that proves this.

Can an organization achieve software process improvement without using the software process maturity model and the software process assessment method?

It may be possible, but having a documented strategy for improvement allows an organization to benefit from lessons learned and improve the strategy over time. The software process maturity model and the software process assessment method comprise one documented approach to improvement.

Who at the organization should select the projects and the functional area representatives?

It doesn't really matter who does the selecting as long as the selection criteria given in this document is followed and there is agreement among the organization's management chain (the project manager up to the senior site representative).

What does the SEI mean by confidentiality? Who at the SEI sees the final reports of an SEI-assisted assessment?

Every organization defines confidentiality differently. In the case of the SEI, the assessment final reports are treated as special reports. All staff members must abide by the confidentiality provisions in the assessment agreement. A special report is never available to anyone except for those listed below:

1. The SEI assessment team members.
2. Process Program members, including secretaries who are required to assist with the actual creation of the report.
3. SEI Information Management, usually one professional editor and a document production specialist.
4. The SEI director.
5. Persons at the SEI who have a "need to know" and have the approval of Process Program director.
6. Process Program staff who are doing data analysis.

What are the phases of the SEI-assisted assessment and how long are they?

The six SEI-assisted assessment phases are:

1. Selection Phase - This time is determined by the SEI and it does vary. The selection criteria in Chapter 3 must be satisfied. After selection, the organization may be placed on a waiting list.
2. Commitment Phase - The organization determines the length of this phase.
3. Preparation Phase - This phase takes about two months and includes the time needed for the selection of the assessment team and the assessment participants, the half-day pre-assessment team training presentation, the two-day assessment team training, and the preparation for the assessment.
4. Assessment Phase - The actual assessment takes four days.
5. Report Phase - This phase takes about five to six weeks. It includes the time needed to write the report, the time for two report reviews, and the time for professional editing. Also included is the time for the recommendations presentation.
6. Assessment Follow-up Phase - The time needed for action plan development depends on the organization but usually is three to six months. Executing the action plan takes the greatest amount of time. Currently there is little data on execution, but an estimate is about eighteen months before another assessment is needed.

Phases 2-5, which are the heart of the assessment, take about five months. To summarize, assessments are a lot of work, and a great deal of preparation and follow-up are necessary for an assessment to be successful.

What do the results of an assessment really look like?

The output of an assessment is basically the final report. The report documents the assessment findings and recommendations, along with the details of the assessment. Since assessments are preludes to action, other results include the initiation of the changes that are necessary for software process improvement. Action plan formulation and execution are also results of an assessment.

Appendix E: Assessment Glossary of Terms

action plan: A plan that addresses how to implement the recommendations in an assessment final report, including the detailed actions and the change necessary. See *action task*.

action task: The part of an action plan that addresses how a specific recommendation or recommendations in the assessment final report will be implemented.

assessment agreement: An agreement between the SEI and the organization to be assessed that states the terms and conditions of the SEI-assisted assessment.

assessment findings: The assessment team's view of the most important software process issues or problems facing an organization.

assessment follow-up phase: The last assessment phase, which consists of formulating the action plan from the assessment final report, executing the action plan to implement the assessment recommendations, and striving for software process improvement.

assessment process: The assessment process is generally made up of five phases: commitment, preparation, on-site assessment, report, and assessment follow-up. The SEI-assisted assessment process adds a sixth phase to the beginning of the assessment process: the selection phase.

assessment recommendations: The description of the actions to be taken to correct or improve the situations identified in the assessment findings and their consequences.

assessment recording form: This form is used to record each yes or no answer from the maturity questionnaire so the data can be scored and analyzed.

assessment team: A team of experienced software professionals that are trained in the software process assessment method to perform assessment(s).

assessment team training: A two-day training program for the assessment team members to build a coherent team and to learn the assessment process, the software process improvement cycle, and the software process assessment methodology.

change agent: An individual or group that has sponsorship and is responsible for implementing or facilitating change(s). An example of a change agent is the software engineering process group. This is in contrast to a change advocate, who is an individual or group who wants to achieve a change but lacks sufficient sponsorship.

change sponsor: An individual or group who legitimizes, authorizes, and supports the change. In an assessment, this person is usually the senior site manager.

commitment phase: In this phase of the assessment process, an organization makes a commitment to conduct an assessment.

final report: The report contains the findings and recommendations, along with the details of the assessment.

findings: See *assessment findings*.

functional areas: Technical areas or unit operations of the software process. For a typical assessment these are: software quality assurance and release, software integration and test, coding and unit test, detailed design, requirements and high-level design.

functional area representatives: The software professionals representing one or more of the functional areas for a software process assessment.

on-site assessment phase: The phase of the assessment process in which the actual assessment is conducted at the organization's site.

pre-assessment team training presentation: A presentation given by the SEI assessment team leader or SEI assessment coordinator to the site assessment team members to prepare them for the assessment team training.

preparation phase: This phase of the assessment process is devoted to preparing for the on-site assessment.

process: A set of actions, tasks, and procedures that when performed or executed obtain a specific goal or objective.

project representatives: The software professionals representing a project to be assessed. These usually are the project leader and any optional support from one or more of the project technical professionals.

recommendations: See *assessment recommendations*.

report phase: The phase of the assessment process that is concerned with formulation and communication of final assessment findings and recommendations. This is usually accomplished through a written final report and oral presentation.

scoring templates: The templates used to score the initial software process maturity level from the data on the assessment recording forms.

SEI-assisted assessments: Software process assessments that are assisted by the SEI, that is, which are conducted by an assessment team with members from both the SEI and the organization to be assessed.

selection phase: The first phase of the SEI-assisted assessment process, in which the SEI selects a candidate organization for a software process assessment.

senior site manager: The senior manager who sets the operational priorities for the organization.

software: Computer programs, procedures, rules, and possibly associated documentation and data pertaining to the operation of a computer system. *IEEE Standard Glossary of Software Engineering Terminology (SET), 1983*

software capability evaluation: An evaluation or review of a contractor's software engineering capability, conducted as part of a software-intensive acquisition or risk abatement program, and performed by a trained evaluation team from the acquisition agency.

software development process: The process by which a user's needs are translated into software requirements, software requirements are translated into design, the design is implemented into code, and the code is tested, documented, and certified for operational use. *IEEE SET Glossary, 1983*

software engineering: The systematic approach to the development, operation, maintenance, and retirement of software. *IEEE SET Glossary , 1983*

software engineering process: The total set of software engineering activities needed to transform a user's requirements into software. The process of applying engineering principles to produce software.

software engineering process group (SEPG): A group of specialists concerned with the software engineering process used by an organization. The SEPG defines and documents the software process, establishes and defines process metrics, supports project data gathering, assists projects in analyzing data, and advises management on areas requiring further attention.

software process: A process performed to produce, support, maintain, and enhance software. Examples of a software process are a software development process, a software maintenance process, etc.

software process assessment: An appraisal or review done by a trained team of software professionals to determine the state of an organization's current software process, to determine the high-priority software process issues that face an organization, and to start the actions needed for software process improvement.

software process improvement: The changes implemented to a software process that bring about improvements.

sponsor: See *change sponsor*.

state of the practice: The commonly accepted level of use of applied scientific or engineering knowledge at a particular time.

statistical process control: The use of statistical techniques to control the quality of a process.

statistical quality control: The use of statistical techniques to control the quality of a product and process.

workshop assessments: Informal assessments conducted at various workshops, conferences, tutorials, or symposiums by the SEI to gather industry profile data.

Table of Contents