Carnegie Mellon
Software Engineering Institute

2002
ANNUAL REPORT

Reporting on the period
from October 1, 2001,
through September 30, 2002




THE SOFTWARE ENGINEERING INSTITUTE (SEI[SM]) IS A FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTER SPONSORED BY THE U.S. DEPARTMENT OF DEFENSE THROUGH THE OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR ACQUISITION, TECHNOLOGY, AND LOGISTICS (OUSD [AT&L]).

THE SEI'S CORE PURPOSE IS TO HELP OTHERS MAKE MEASURED IMPROVEMENTS IN THEIR SOFTWARE ENGINEERING CAPABILITIES.

TABLE OF CONTENTS

INTRODUCTION TO THE SEI

MESSAGE FROM THE DIRECTOR

Software is the engine of innovation in our Internet-connected world. Research yields new ideas that software transforms into new products. Unlike traditional industries such as the automotive and electronics industries, software requires no factories for manufacturing, no costly distribution system, and hence no large infrastructure investment. But it does require the use of disciplined engineering practices by skilled software engineers.

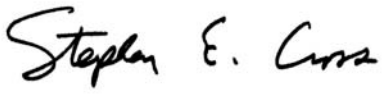
Unfortunately, there continues to be a gap between the state of the art and the state of the practice of software engineering. Commonly used software-development practices result in lost productivity, as time and money are wasted on rework. Data indicate that 60-80% of the cost of software development is rework—that is, fixing defects that are found during testing.* While software must still be tested, testing and rework costs would be reduced if better design and implementation practices were used.

Commercial software products today are riddled with defects—commonly known as "bugs"—that are introduced during the software's design and development. As we come to rely increasingly on systems that are interconnected in networks, the stakes are rising. Defects in products that are accessible to the Internet render them vulnerable to cyber attacks. The SEI's CERT® Coordination Center (CERT/CC) documented more than 4,000 commercial-product vulnerabilities this year and determined that more than 95% of the 82,000 unique cyber incidents it investigated were a direct result of intruders exploiting such vulnerabilities. Yet the massive number of vulnerabilities seen in commercial software can be attributed to a modest number of root causes. These defects, and hence most cyber attacks, could be prevented if vendors used the proven best design techniques of software engineering.

The SEI's core purpose is to help others make measured improvements in their software engineering capabilities. In the SEI's view, the best way to ensure the security of our software is to design software in a way that does not allow defects into software in the first place.

As a college-level unit at Carnegie Mellon University, well known for its highly ranked programs in computer science and engineering, the SEI operates at the leading edge of technical innovation. Since 1984, we at the SEI have been identifying, developing, and advocating practices for designing high-quality software. At the SEI, we emphasize defect prevention through improvement of process and product quality during the early phases of system development.

Our annual report for Fiscal Year 2002 is replete with examples of organizations that have achieved impressive results through the disciplined application of these principles. We continue to believe that the SEI's vision for software engineering—the right software, delivered defect free, on time and on cost, every time—is achievable. Our annual report provides the evidence. We hope you enjoy reading it.



Stephen E. Cross
Director and Chief Executive Officer
Software Engineering Institute

* CHAOS Chronicles II, The Standish Group, 2001[1]

VISION OF THE SEI

The right software, delivered defect free, on time and on cost, every time

- To be successful, integrated teams of developers, acquirers, and software users must have the necessary software engineering skills and knowledge to ensure that the right software is delivered to end users.
- **"Right software"** implies software that satisfies requirements for functionality, performance, and cost throughout its lifetime.
- **"Defect-free"** software is achieved either through exhaustive and endless rework or by developing the code right the first time. The SEI's body of work in technical and management practices is focused on developing it right the first time, which results not only in higher quality, but also in predictable and improved schedule and cost.

MISSION OF THE SEI

The SEI is a preeminent software engineering R&D technology center.

The SEI provides the technical leadership to advance the practice of software engineering so the DoD can acquire and sustain its software-intensive systems with predictable and improved cost, schedule, and quality. The SEI mission includes four objectives:

1. **accelerate** the introduction and widespread use of high-payoff software engineering practices and technology by identifying, evaluating, and maturing promising or underused technology and practices
2. **maintain** a long-term competency in software engineering and technology transition
3. **enable** industry and government organizations to make measured improvements in their software engineering practices by working with them directly
4. **foster** the adoption and sustained use of standards of excellence for software engineering practice

STRATEGY OF THE SEI

The SEI's strategic approach to achieving its mission can be summarized in three words: **create, apply,** and **amplify.**

Create

The SEI works with the research community to help create and identify new and improved practices.

The SEI creates and identifies emerging or underused solutions to significant and pervasive software engineering problems and develops these solutions so that they can be applied by software developers and acquirers to improve their software engineering practices. The SEI enters into cooperative research and development agreements (CRADAs) with industry and academia to test new and emerging technologies.

Apply

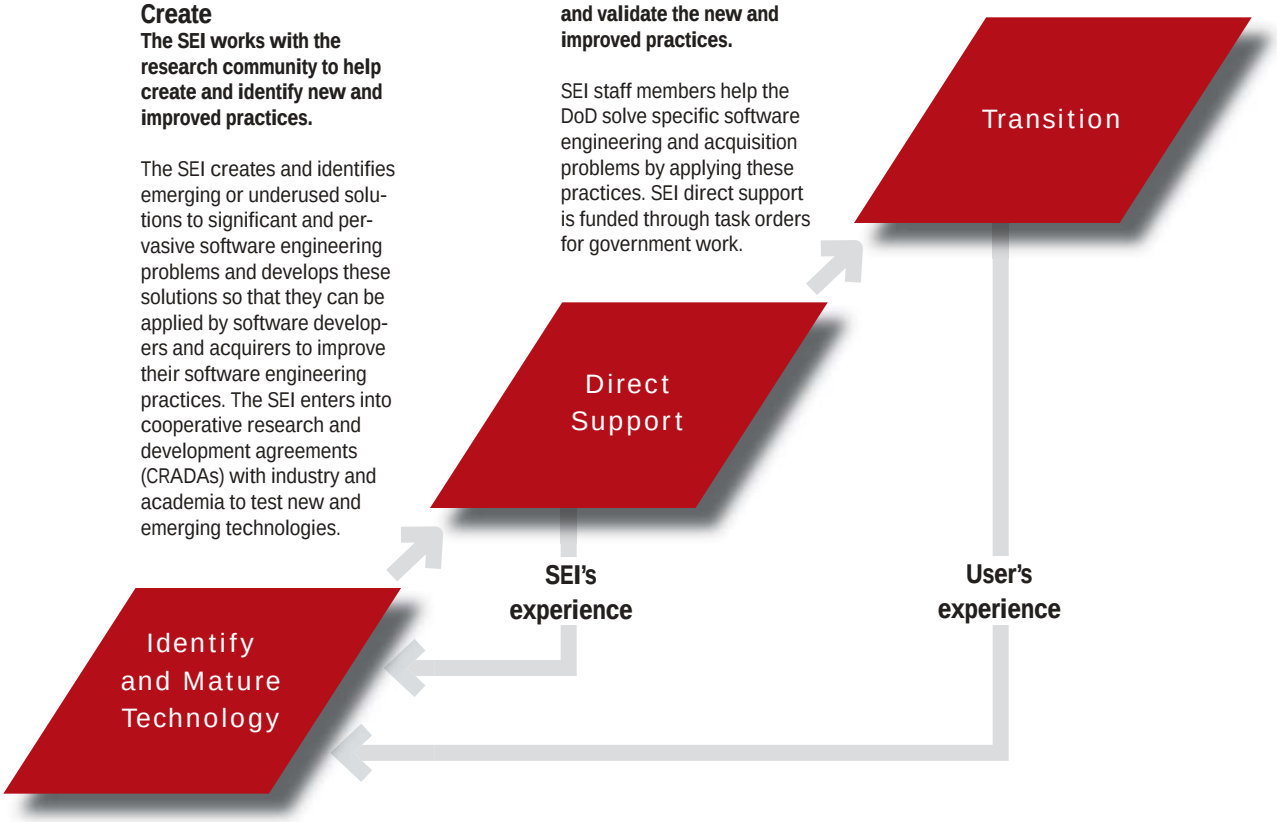
The SEI works with leading-edge software developers and acquirers to apply and validate the new and improved practices.

SEI staff members help the DoD solve specific software engineering and acquisition problems by applying these practices. SEI direct support is funded through task orders for government work.

Amplify

The SEI works through the global community of software engineers to amplify the impact of the new and improved practices by encouraging and supporting their widespread adoption.

The SEI works closely with DoD engineering organizations. In addition, the SEI offers continuing education courses based on matured, validated, and documented solutions. The SEI also licenses the packaging and delivery of new and improved technologies, working with developers and acquirers as well as with "transition partners"—DoD and industry organizations that help others adopt new technology.



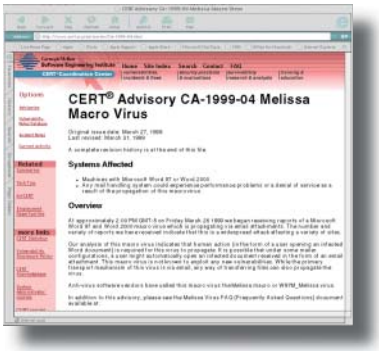
A BRIEF HISTORY OF THE SEI

U.S. Rep. John Murtha

1984, with the support of **U.S. Rep. John Murtha** of Pennsylvania, Congress and the U.S. Department of Defense (DoD) competitively award the contract for the Software Engineering Institute (SEI) to Carnegie Mellon University in Pittsburgh, PA, originally funded by the Advanced Research Projects Agency through a contract with the Air Force Materiel Command's Electronic Systems Center. In 1997 the sponsor is changed to the Office of the Under Secretary of Defense for Acquisition and Technology (OUSD [A&T]), now named the **Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics (OUSD [AT&L]).**

1988, **CERT® Coordination Center (CERT/CC)** established after Internet worm cripples 10% of computers on Internet. CERT/CC later plays major role in alerting community to vulnerabilities and mitigating damage from attacks, including Melissa virus and ExploreZip Trojan horse (1999), and the Code Red and Nimda worms (2001) (see page 31).

1988, first **Software Engineering Process Group (SEPG℠) Conference** held in Pittsburgh; annual attendance reaches 2,200 in 2001. First European SEPG Conference held in Amsterdam in 1996, co-sponsored by SEI and European Software Process Improvement (ESPI) Foundation. Other SEPG conferences held annually around the world.



1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992

1985, first **SEI Symposium** held in Pittsburgh; attendance reaches 1,200 in 1997.

1989, **SEI Series in Software Engineering** created, published by Addison-Wesley. Currently comprises 25 books, including six published in 2002.

1987, first **Capability Maturity Model® (CMM®)** published. Model is refined and published as Capability Maturity Model for Software (SW-CMM), Version 1.0, in 1991; Version 1.1 released in 1993. By 1995, specialized models are developed for software acquisition (SA-CMM), systems engineering (SE-CMM), integrated product development (IPD-CMM), and organizational workforce capability development (People CMM). 1997, **CMM Integration℠ (CMMI®)** Initiative launched, sponsored by OUSD (A&T) and the National Defense Industrial Association (NDIA). Team from government, industry, and the SEI develops integrated framework for multiple maturity models and associated training and appraisal products. Integrated model for systems engineering and software engineering improvement (CMMI-SE/SW, Version 1.0) published in 2000; Version 1.1 of the CMMI models, appraisal products, and training courses released in 2002 (see page 17).

1987, **Master of Software Engineering** program established by Carnegie Mellon. SEI staff implement and teach six core courses. Program graduates 194 students by August 2002.

1987, SEI moves to current home near Carnegie Mellon campus; later opens branch offices in Arlington, VA (1990), Colorado Springs, CO (1993), Huntsville, AL (2002), and Frankfurt, Germany (2002).

1987, ***Ada Adoption Handbook: A Program Manager's Guide*** published; 2,000 copies of first edition distributed.

1998, first issues of ***news@sei***, a print newsletter, and ***news@sei interactive***, a Web-based publication (http://interactive.sei.cmu.edu), published.

1998, **Software Engineering Information Repository (SEIR)** Web site created to provide a forum for exchange of information on software engineering improvement. Today SEIR includes more than 450 documents and 10,300 Web pages, and has 17,000 members from 5,000 organizations in 80 countries (see page 29).

1999, Version 1.0 of the **Operationally Critical Threat, Asset, and Vulnerability Evaluation℠ (OCTAVE℠)** framework, a self-directed risk evaluation for information security, published (see page 32).

1999, ***A Framework for Software Product Line Practice℠***, a Web-based compendium of activities and practices necessary to succeed with software product lines, developed. More than 38 organizations report use of the framework in 2002 (see page 26).

2002, first **International Conference on COTS-Based Software Systems (ICCBSS)** held (see page 46).

2002, **Acquisition Support Program** established to help DoD and other government entities improve acquisition of software-intensive systems (see page 13).

1993 1994 1995 1996 1997 1998 1999 2000 2001 2002

1993, *A Practitioner's Handbook for Real-Time Analysis: Guide to Rate Monotonic Analysis (RMA) for Real-Time Systems* published. RMA is a collection of quantitative methods and algorithms that allows engineers to specify, analyze, and predict timing behavior of real-time software systems. RMA principles later influence such standards as IEEE Futurebus+, POSIX, and Ada 95. In 1998, RMA techniques are credited with helping NASA restart the Mars Pathfinder after a system shutdown.

1993, **Personal Software Process℠ (PSP℠)** introduced to encourage individual software engineers to use disciplined processes; leads to **Team Software Process℠ (TSP℠)** in 1996, to help software teams predict and meet development schedules and develop software with unprecedented accuracy and quality (see page 34).

2000, **COTS Usage Risk Evaluation℠ (CURE℠)** method developed to provide early assistance for program managers preparing to oversee commercial off-the-shelf (COTS)-based programs (see page 20).

2000, **Technology Insertion, Demonstration, and Evaluation (TIDE) Program** established. Funded through appropriation secured by **U.S. Rep. Michael Doyle** of Pennsylvania, TIDE helps small manufacturing enterprises adopt state-of-the-art software technology to improve profitability and efficiency of small defense and commercial manufacturers by overcoming barriers to technology adoption (see page 39).

2000, first **Software Product Line Conference** held (see page 47).

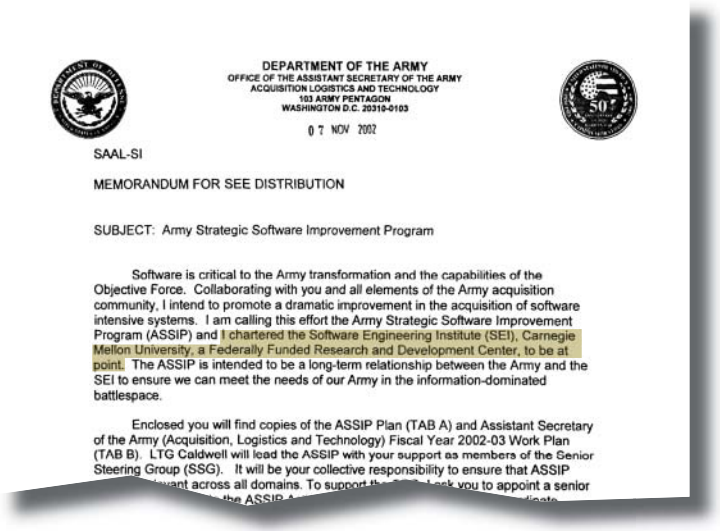
2001, Internet Security Alliance formed as partnership between SEI and Electronic Industries Alliance (EIA) to advance information-security practices by representing industry's interests and identifying best practices in Internet and network security.

INTERNET SECURITY ALLIANCE

HIGHLIGHTS FOR 2002

The SEI's three major priorities in 2002 were

1. to **enhance its impact in the acquisition community.** As a DoD-supported research and development center, the SEI works to ensure that the U.S. is ready to respond to constantly changing threats, and that the systems acquired and employed by the DoD are useful and reliable over extended periods of time in a wide variety of scenarios. The SEI helps to identify the engineering practices, knowledge, and technologies that enable organizations to acquire the software they need to achieve their missions.
2. to **enhance the science and technology content** of SEI work and ensure that the SEI stays on the leading edge of the field of software engineering. The SEI exercises leadership in software product lines, architecture-centered design, networked systems survivability, the assembly of systems from software components, and other key science and technology competencies.
3. to **partner with the software engineering community.** The SEI collaborates with the global community of software engineers in diverse market segments to build market awareness and to support the community's adoption and use of best practices in software engineering.



DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY
ACQUISITION LOGISTICS AND TECHNOLOGY
103 ARMY PENTAGON
WASHINGTON D.C. 20310-0103

07 NOV 2002

SAAL-SI

MEMORANDUM FOR SEE DISTRIBUTION

SUBJECT: Army Strategic Software Improvement Program

Software is critical to the Army transformation and the capabilities of the Objective Force. Collaborating with you and all elements of the Army acquisition community, I intend to promote a dramatic improvement in the acquisition of software intensive systems. I am calling this effort the Army Strategic Software Improvement Program (ASSIP) and I chartered the Software Engineering Institute (SEI), Carnegie Mellon University, a Federally Funded Research and Development Center, to be at point. The ASSIP is intended to be a long-term relationship between the Army and the SEI to ensure we can meet the needs of our Army in the information-dominated battlespace.

Enclosed you will find copies of the ASSIP Plan (TAB A) and Assistant Secretary of the Army (Acquisition, Logistics and Technology) Fiscal Year 2002-03 Work Plan (TAB B). LTG Caldwell will lead the ASSIP with your support as members of the Senior Steering Group (SSG). It will be your collective responsibility to ensure that ASSIP [illegible] across all domains. To support [illegible] ask you to appoint a senior [illegible] the ASSIP [illegible]

A memo from Assistant Secretary of the Army Claude Bolton calls for "a long-term relationship between the Army and the SEI to ensure we can meet the needs of our Army in the information-dominated battlespace."

Acquisition

The SEI enhanced its impact in the acquisition community in 2002 by establishing an **Acquisition Support Program (ASP)** to focus its work in ways that are strategically important to senior acquisition officials in each military service (Air Force, Army, and Navy). Assistant Secretary of the Army (Acquisition, Logistics and Technology) (ASA ALT) Claude Bolton created an Army Strategic Software Improvement Program in August that is based on a close working collaboration with the SEI. To help transition technology and best practices to the U.S. Army, the SEI also established an on-site office at the Army's Aviation and Missile Command (AMCOM) in Huntsville, AL. (For more information about the ASP, see page 13.)

At the request of the office of ASA ALT and program executive officers for the various users of Force XXI Battle Command Brigade and Below (FBCB2), the principal tactical digital command-and-control system for the Army, the SEI performed an extensive study of the FBCB2 software architecture (see page 16). The SEI also supported the Air Force, through technical projects for the Military Satellite Communications (MILSATCOM) System Program Office and the Electronic Systems Center (ESC); and the Navy, through work on the DD(X) Program and the Navy Open Architecture Initiative.

In January, the SEI hosted a **DoD Software Collaborators Workshop** for the DoD acquisition community at the SEI's Arlington, VA, facility (see page 45). Relationships established at this workshop led to memoranda of understanding for collaborations with key organizations such as the MITRE Corporation, the Aerospace Corporation, and the Applied Physics Laboratory at Johns Hopkins University.

Information Security

The SEI's work in information security continues to have worldwide impact, particularly in light of contemporary concerns about homeland security. The staff of the SEI's **CERT® Coordination Center (CERT/CC)** provides trusted technical advice to the staff of the President's Critical Infrastructure Protection Board (PCIPB) and other important government organizations (see page 31). In 2002, the SEI also responded to requests for assistance and information from the National Threat Assessment Center, the National Security Council, the National Infrastructure Protection Center, the board's Cyber Interagency Working Group, and the Office of Management and Budget/General Services Administration Electronic Government Initiatives.

The SEI's CERT Analysis Center provided cyber security support to the 2002 winter games and Super Bowl XXXVI.

The United States Secret Service (USSS) and the SEI's **CERT Analysis Center (CERT/AC)** collaborated on a project called the Critical Systems Protection Initiative (CSPI), intended to strengthen the planning phase of the Secret Service's protective mission by determining how critical information networks are related to physical protection activities. The analysis of critical systems and other forms of cyber security were integral components in the planning and execution of the security plans for both Super Bowl XXXVI in New Orleans, LA, and the 2002 winter games in Salt Lake City, UT. Both events were supported by the CERT/AC. The USSS and the CERT/AC also collaborated on the Insider Threat Study Advisory Board for the analysis of the physical and online behavior of malicious insiders before and during network compromises. Reports on this work will be available to the Department of Defense (DoD), law enforcement, and industry. The advisory board is composed of individuals from federal civilian agencies, academia, industry, and the DoD.

This year, the CERT/CC helped coordinate a worldwide response to vulnerabilities discovered in the simple network management protocol (SNMP). The CERT/CC contacted more than 280 vendors, many of whom contributed statements for CERT/CC Advisory CA-2002-03, which was published to enable the Internet community to protect itself. The day after the advisory was released, it had already been viewed on the Web more than 100,000 times, and the mailing list that the CERT/CC created specifically for the SNMP problem had more than 400 subscribers (see page 32).

Adoption of the SEI's approach for evaluating information-security risks, the **Operationally Critical Threat, Asset, and Vulnerability Evaluation℠ (OCTAVE℠)** method, increased in 2002 (see page 32). Addison-Wesley published the book ***Managing Information Security Risks: The OCTAVE Approach*** in 2002 as part of the SEI Series in Software Engineering. More than 1,000 copies of the OCTAVE Method Implementation Guide were distributed and four public sessions of the OCTAVE training course were offered to individuals and teams during 2002. In addition, the first **OCTAVE Users' Forum** was held in September 2002 in Washington, DC (see page 46), and the SEI developed an initial version of **OCTAVE-S,** an information-security assessment technique tailored for small organizations (see page 41).

The General Services Administration is using another SEI assessment approach, the e-Authentication risk and requirements analysis (e-RA), to assist the 24 federal electronic government initiatives to define standardized levels of authentication and identity and to define requirements for an authentication gateway (see page 32).

A Sept. 18, 2002, *Washington Post* article titled "Key Players in U.S. Government's Cybersecurity Efforts" lists **Richard D. Pethia,** director of the SEI Networked Systems Survivability Program, which includes the CERT/CC and CERT/AC, as one of the key players. Among others listed are Richard Clarke, then cybersecurity adviser to President Bush; Ron Dick, director of the National Infrastructure Protection Center; and—from the private sector—Scott Charney, Microsoft's chief security strategist. In an Aug. 15, 2002, article titled "Sleuths Invade Military PCs With Ease," the *Washington Post* also referred to the CERT/CC as "the leading clearinghouse of information about intrusions, viruses, and computer crimes."

The World Bank Financial Sector released a policy publication in June 2002 *(Electronic Security: Risk Mitigation in Financial Transactions)* commending the **Internet Security Alliance**[2] and the CERT/CC for providing the kind of public–private sector cooperation it says is needed to improve electronic security worldwide. The Internet Security Alliance is a collaboration between the CERT/CC and the Electronic Industries Alliance.

U.S. Homeland Security Secretary Tom Ridge with SEI Director Steve Cross.

Process Improvement

The SEI has been in the forefront of efforts to improve the quality of processes in product and service development and maintenance organizations since the late 1980s. The SEI first met this objective by way of the **Capability Maturity Model® (CMM®) for Software (SW-CMM).**

This year, the SEI released Version 1.1 of the **CMM Integration℠ (CMMI®) Product Suite** (models, appraisal methods, and training) to provide best practices for organizations that develop and maintain software-intensive products and services. With the CMMI Product Suite, the SEI continues to provide intellectual leadership in helping organizations define, use, and improve their software development processes. The SEI is also defining a migration path to help organizations move from improvement based on the SW-CMM to improvement based on the CMMI Product Suite (see page 17).

The SEI has also produced tools that support process improvement at the individual **(Personal Software Process℠, PSP℠)** and team **(Team Software Process℠, TSP℠)** levels (see page 34). TSP and PSP can be used with any CMM. Experience continues to demonstrate that TSP and PSP enable organizations to accelerate achievement of Maturity Level 4 and 5 capabilities. The Naval Air Systems Command (NAVAIR), for example, reported improvement from SW-CMM Level 1 to Level 4 in 30 months with the help of TSP and PSP. Most organizations take an average of six years to achieve Level 4.

Science and Technology

To stay on the leading edge of the field of software engineering, the SEI conducts **independent research and development (IR&D) studies** of the feasibility and potential impact of emerging technologies (see page 37). Topics investigated in feasibility studies this year include agent-based architectures, enterprise integration applications, flow-service-quality systems engineering, data fusion for the predictive analysis of network intrusions, and open source software. The results of these IR&D studies were published in an SEI technical report.

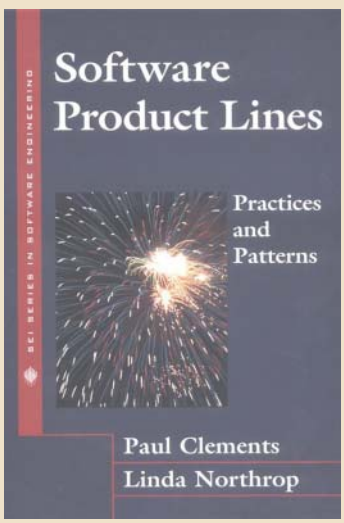
A new SEI technical initiative, **Predictable Assembly from Certifiable Components** (PACC), grew out of an IR&D study that established the potential long-term value of continued SEI work on the subject. Through its work in PACC, the SEI will provide seminal technology to certify software components for predictable assembly and to open up a new world of trusted software components, ensuring that the builders of systems can select software components on the basis of their predicted runtime behavior within specific assemblies (see page 24).

To help manage risks in the use of commercial off-the-shelf (COTS) products, the SEI developed the **COTS Usage Risk Evaluation℠ (CURE℠).** This two-day assessment involves site visits by SEI personnel to the program office and contractor for COTS-based acquisitions. The SEI released CURE Version 2.0 in 2002 and applied it on four program evaluations (see page 20).

The **Addison-Wesley SEI Series in Software Engineering**[3] provides software engineering practitioners with current, in-depth information to help them use and apply mature and continually improving software engineering practices. Six books were published this year in the SEI Series, including ***Software Product Lines: Practices and Patterns,*** written by Paul Clements and Linda Northrop, which describes how leading-edge software development organizations have retooled for product lines (for more information about software product lines, see page 26); and ***Documenting Software Architectures: Views and Beyond,*** by Clements and other SEI staff members, written to help practicing architects produce comprehensive documentation packages for software architectures.

The SEI collaborates on many science and technology projects with the academic units of **Carnegie Mellon University,** including the Carnegie Institute of Technology and its Center for Computer and Communications Security; the School of Computer Science and its Master of Software Engineering program and High-Dependability Computing research program; the Graduate School of Industrial Administration; and the H. John Heinz III School of Public Policy and Management and its CIO Institute.

In 2002, Addison-Wesley published six books in the SEI Series in Software Engineering.



The SEI and Carnegie Mellon worked with historically black colleges and universities and Hispanic-serving institutions to train the next generation of Internet-security experts.

Partnering with the Community

To help transition best practices to the software engineering community, the SEI and the European Software Process Improvement (ESPI) Foundation agreed in 2002 to work together to market and deliver public offerings of the SEI's advanced training courses throughout Europe. ESPI is brokering the delivery of the Introduction to CMMI courses by SEI transition partners. Plans were also completed this year for the SEI to open a satellite office in Frankfurt, Germany; **SEI-Europe℠ GmbH** was officially established at the end of the 2002 calendar year.

The SEI also participated with Carnegie Mellon University in providing educational resources to historically black colleges and universities and Hispanic-serving institutions. This program enables PhD computer scientists to teach survey-level courses in information security to advanced undergraduate and first-year graduate students at their universities, helping to create a next generation of Internet-security experts. Partners with Carnegie Mellon in the program, funded by the National Science Foundation (NSF), included Howard University, Morgan State University, and the University of Texas at El Paso.

The SEI continues to stimulate the creation and growth of worldwide communities and to generate worldwide interest in best software practices by means of conferences that the SEI sponsors or co-sponsors (see page 44). Examples include the **International Conference on COTS-Based Software Systems**, the **Software Product Line Conference**, the **Software Engineering Process Group Conference**, and the **European Software Engineering Process Group Conference**.

Increased partnering with the community is also reflected in the large number of affiliates, visiting scientists (see page 58), and transition partners (DoD and industry organizations that help others adopt new technology; see page 67) who worked with the SEI in 2002. The SEI had 17 affiliates and 73 visiting scientists on staff and entered into licensing agreements with 66 new transition partners in FY2002.

SEI FOCUS AREAS

ACQUISITION SUPPORT PROGRAM

The DoD must be ready to respond to constantly changing threats. Furthermore, the systems employed by the DoD must be useful over extended periods of time in multiple scenarios. Such requirements call for systems with rich functionality. Today, almost all DoD systems are software intensive and are no longer developed internally, but rather are acquired from commercial sources.

The task of acquiring complex software-intensive systems has been and continues to be problematic. The primary objective of the SEI's Acquisition Support Program[4] (ASP) is to help acquirers identify and characterize the complexity associated with acquiring systems, to decrease that complexity, and to mitigate the risks associated with acquiring those systems. The program was formed to identify, within the entire field of software engineering, the engineering practices, knowledge, and technologies that best improve the ability of acquisition organizations to meet their acquisition challenges.

Purpose

The purpose of the ASP is to help the DoD and other government acquirers make evolutionary and revolutionary improvements in the acquisition of software-intensive systems. The SEI accomplishes this with three strategies. First, by working with the acquisition community, the SEI is able to characterize and analyze the state of the practice for acquiring software-intensive systems. Second, the SEI uses this knowledge to deliver and transition advanced software engineering and acquisition practices directly into key acquisition programs in the DoD and the federal government. Finally, through the use of transition partners, collaborators, and an emerging acquisition community of practice, the SEI generalizes the successful applications of technology for wide dissemination throughout the acquisition community.

Accomplishments

Strategic Impact Programs Established

The SEI established strategic impact programs (SIPs) for each military service (Air Force, Army, and Navy) in FY2002, and now has an on-site office at the Army's Aviation and Missile Command (AMCOM) in Huntsville, AL. The first priority of the ASP is to contribute to the success of acquisition programs that fall within the scope of a military service SIP. Delivery teams focus on understanding and meeting the needs of programs within an SIP.

Best Practices Transitioned to DoD by SEI, Transition Partners

The SEI is working with the DoD to help transition mature software engineering and acquisition practices into their programs. Early involvement to help establish sound engineering and management practices provides the foundation for program success. The SEI has helped write contract language and evaluation criteria, and has created monitoring mechanisms to ensure that contractors use credible engineering practices for critical DoD systems.

In addition to direct support to key acquisition programs, the SEI finds and teams with transition partners to help amplify and disseminate best practices within the acquisition community. One example is the AMCOM Software Engineering Center (SEC) in Huntsville, AL. As a Maturity Level 4 development organization, as rated by the Capability Maturity Model® for Software (SW-CMM®), SEC is the Army's conduit for transitioning enhanced SEI practices into the Army's engineering and acquisition communities. (See page 17 for more about Capability Maturity Models.)

Alliances with Other Organizations Established

The SEI helps raise the organic engineering capabilities in the acquisition community by seeking out mutually beneficial collaborations with well-respected systems-engineering organizations. Formal agreements have been made with the MITRE Corporation, the Aerospace Corporation, and Johns Hopkins University's Advanced Physics Lab to initiate collaborative work on reducing risks in the acquisition and development of software-intensive systems.

Software Collaborators Workshop Organized

SEI staff members organized and participated in the DoD Software Collaborators Workshop (see page 45). This workshop enabled participants to identify the most common problems encountered in DoD acquisitions and potential solutions to those problems.

Contract Monitoring Research Could Reduce Costs

The SEI helped the National Reconnaissance Office (NRO) develop and implement a post-contract monitoring process based on the CMM Integration℠ (CMMI®) Product Suite (see page 17). An acquisition pilot process was defined and potential pilots were identified. The SEI participated with the NRO to test whether CMMI appraisals could be reused, thereby lowering the cost incurred in conducting multiple evaluations for the same development organization. These activities will help the NRO and others to design a cost-effective approach to contract monitoring while fostering positive relationships with contractors.

The SEI is working with the U.S. Army on the Future Combat Systems (FCS) program, which will lead to a lighter, faster, and more lethal Army by 2010. The Comanche helicopter program is being restructured as one of the first FCS systems.

ARCHITECTURE TRADEOFF ANALYSIS

Developers and acquirers of complex software systems need their systems to be modifiable and to perform predictably. They may also need them to be secure, interoperable, portable, usable, and reliable. These quality attributes depend more on the software architecture than on code-level practices, such as language choice. Moreover, these qualities do not exist in isolation. Performance affects modifiability, interoperability affects security, and everything affects cost.

An architecture either explicitly or implicitly makes tradeoffs among these qualities, often with undesirable consequences. The SEI has developed a high-payoff method for identifying the relationships and tradeoffs among such quality attributes. The Architecture Tradeoff Analysis Method℠ (ATAM℠) enables software developers and acquirers to evaluate an architecture for required quality attributes and business goals before the system is actually developed. Because architectural decisions are difficult and expensive to change later, an early evaluation with a proven method makes sense.

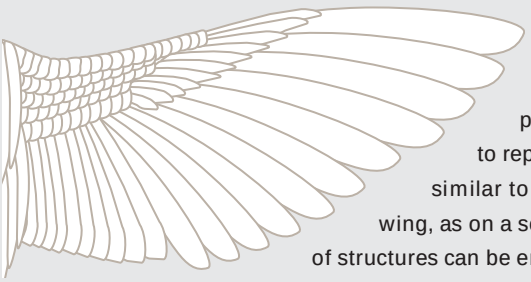
Purpose

The SEI's work in software architectures[5]

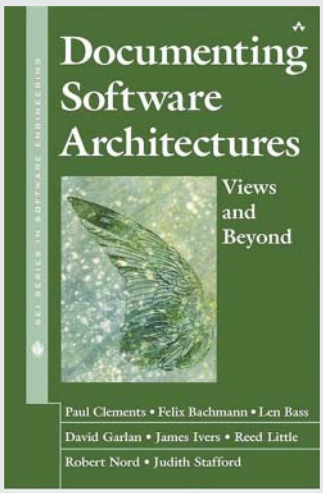
- ensures that architectural errors in software-intensive systems can be detected early in development or evolution, when the cost to fix them is minimal and the reduction in total cost of system ownership is the greatest
- provides acquirers and developers with a high-level capability for evaluating software architectures: the ATAM and its variants. By conducting architecture evaluations on existing and proposed software, acquirers and developers exert significantly greater control over key software qualities, such as affordability, reliability, security, modifiability, and performance. Conducting ATAM evaluations also helps to mitigate the risks involved in making the necessary tradeoffs among these software qualities.
- provides acquirers and developers with effective architectural practices based on best commercial practices in leading software organizations

Documenting Software Architectures *is of immense value.* *The description and communication of software architecture is quite crucial to its many stakeholders, and this handbook should save you months of trials and errors, lots of undeserved hassle, and many costly mistakes that could potentially jeopardize the whole endeavor.* ***It will become an important reference on the shelf of the software architect.***

Philippe Kruchten
Director of Process Development, Rational Software Canada



The cover of *Documenting Software Architectures* (see page 16) shows a bird's wing to represent a physiological system similar to an architecture. On a bird's wing, as on a software system, any number of structures can be emphasized—feathers, skeleton, circulatory system, musculature. Each structure must be compatible with the others and work toward fulfilling a common purpose. The wing exhibits strong quality attributes: lightness in weight, aerodynamic sophistication, and outstanding thermal protection. The wing's reliability, cycling through millions of beats, is unparalleled.



Accomplishments

New Book, Documenting Software Architectures, *Published*

Documenting Software Architectures, published this year in the SEI Series in Software Engineering,[3] was written by SEI staff members to help practicing architects produce a comprehensive documentation package for a software architecture that will be useful to its many stakeholders. The approach is view based; the fundamental principle is that documenting an architecture consists of documenting the relevant views of that architecture and then documenting the information that applies to more than one view.

Architecture Training Courses Developed

The SEI has developed new courses to help software practitioners and acquirers better understand architectural principles and best practices. The Software Architecture Familiarization course, based on the book *Software Architecture in Practice, Second Edition*, provides the fundamentals. The ATAM Evaluators Training course prepares qualified practitioners to perform ATAM evaluations. The tutorial Integrating Software Architecture Analysis and Evaluation in DoD System Acquisitions presents architecture evaluation practices in an acquisition context and provides guidelines for their use. These courses were piloted in FY2002 and will be among the SEI's public courses in FY2003.[6]

Architecture Tradeoff Analysis Method Stabilized; Adoption Program to Begin

The SEI has been developing and piloting the ATAM and associated architecture tradeoff technology for several years. The method has been technically validated in both commercial and DoD applications and has now stabilized. The SEI is preparing to offer adoption packages to outside organizations to perform SEI-authorized ATAM evaluations. The adoption package includes SEI training and coaching to prepare individuals from those organizations.

Army Uses Analysis of Software Architecture

Force XXI Battle Command Brigade and Below (FBCB2) is the principal tactical digital command-and-control system for the U.S. Army from the brigade level down to the soldier. This system consists of rugged computer hardware running FBCB2 software, installed on a variety of weapons platforms and linked through a radio network. The situational awareness services of FBCB2 software provide answers to three questions that are critical for soldiers during battle:

1. Where am I?
2. Where are my fellow soldiers?
3. Where is the enemy?

FBCB2's command-and-control services provide leaders with the ability to rapidly assess and control the battle space even under adverse conditions.

At the request of the office of the Assistant Secretary of the Army (Acquisition, Logistics and Technology) and program executive officers for the various users of FBCB2, the SEI performed an extensive study of the FBCB2 software architecture to determine the architectural changes to consider for near-term and long-term improvement and increased efficiency. The SEI is now working closely with the FBCB2 program office and its supporting contractors to build on the program's successes and implement the study's architectural recommendations to provide a solid foundation for future success.

FBCB2 software will give future soldiers, such as the Land Warrior, much greater knowledge of their positions relative to the enemy and their fellow soldiers. The SEI is working with the Army on the architecture for FBCB2 software.

CAPABILITY MATURITY MODEL INTEGRATION

Organizations frequently focus attention on assets such as people, methodologies, tools, and equipment. These elements are coordinated through processes that offer a means of control. Adequate processes enable organizations to manage people and technologies effectively, thereby making it easier for organizations to meet their business objectives.

For 10 years, the Capability Maturity Model® for Software (SW-CMM®) has provided a consistent and proven approach for appraising the maturity of an organization's software processes and for identifying the best practices to improve those processes. Used by more than 5,000 organizations worldwide, the SW-CMM model has become a de facto standard for appraising and improving software processes.

As organizations came to know and experience the value of the SW-CMM model, CMM models were developed for other disciplines, such as software acquisition, systems engineering, integrated product development, and organizational workforce capability development. The CMM concept evolved into the development of the CMM Integration℠ (CMMI®) Product Suite.[7] The CMMI Product Suite comprises models, an appraisal method, and training that enable organizations to integrate their process-improvement programs across multiple functions and disciplines.

Compared with previous CMM models, CMMI best practices

- cover the product life cycle in more detail
- focus more on projects, products, and services
- incorporate more bodies of knowledge
- contain more robust high-maturity practices

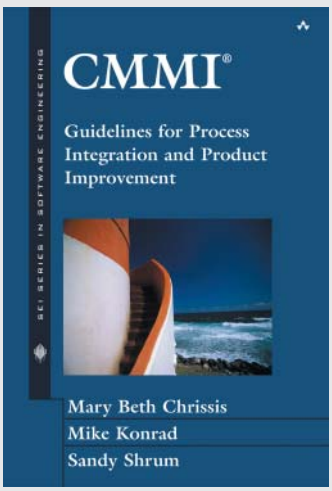
Purpose

Through CMMI, the SEI and others are developing and promoting the widespread adoption of Capability Maturity Model concepts in ways that support integrated process improvement across disciplines, the enterprise, and the product life cycle. Disciplines currently covered by CMMI best practices are software engineering, systems engineering, integrated product and process development, and supplier sourcing.

SEI work in CMMI focuses on

- maintaining the CMMI Product Suite and supporting its evolution
- enabling organizations to adopt and use the CMMI Product Suite
- helping existing users of the SW-CMM model to upgrade to CMMI models
- developing improvements to the CMMI Product Suite based on feedback from users
- interpreting CMMI models for application to additional bodies of knowledge, such as safety and security
- ensuring that the People CMM model for workforce development and the Software Acquisition CMM complement the CMMI Product Suite

The book *CMMI®: Guidelines for Process Integration and Product Improvement* is the definitive source book for CMMI model information. Readers can use the book to learn best practices that help organizations improve their development and maintenance of products and services.



Lockheed Martin issued a new corporate policy stating that it will apply the highest standards of engineering excellence to all projects. As part of the policy, it is requiring each of its business units to attain, by January 2005, at least a CMMI Maturity Level 3 against the SEI's CMMI for Systems Engineering/ Software Engineering/ Integrated Product and Process Development/ Supplier Sourcing model. After an initial appraisal, business units are strongly encouraged to move up to the next-higher CMMI level about every two years, until they reach Maturity Level 4 or 5.

Accomplishments

CMMI Product Suite Version 1.1 Released

The SEI released Version 1.1 of the CMMI Product Suite to provide best practices for organizations that develop and maintain software-intensive products and services. This suite of products includes collections of best practices (the CMMI models), a method used to appraise an organization's use of these best practices (the Standard CMMI Appraisal Method for Process Improvement [SCAMPI[SM]]), and training courses to support the effective use of these products.

The CMMI Product Suite incorporates best practices from several process improvement models that helped pioneer process improvement in government and industry. The product suite also incorporates the best ideas of several methods used to appraise the use of these best practices in the *SCAMPI Method Definition Document*.[8] Organizations that have used the CMM models for software, systems engineering, and integrated product development will find that they can use their experience with these models to make the adoption of the CMMI Product Suite easier than it would be without such experience. Some organizations are already moving quickly from the SW-CMM to CMMI and retaining their maturity level rating.

SCAMPI Version 1.1 Method Implementation Guide Released

SCAMPI Version 1.1: Method Implementation Guidance for Government Source Selection and Contract Process Monitoring[9] provides guidance to organizations that anticipate performing a SCAMPI appraisal as a basis for government source selection for contract award or for determining suitable team relationships or prime contractor/subcontractor arrangements. It addresses the use of SCAMPI appraisals for monitoring adherence to processes. This guide is intended for those authorized by the SEI to lead SCAMPI appraisals (SCAMPI Lead Appraisers[SM]) implementing the SCAMPI method in government acquisition environments.

CMMI Advanced Training Courses Released

The SEI released advanced CMMI courses[6] to support Version 1.1 of the CMMI Product Suite. These advanced courses include

- Intermediate Concepts of CMMI, designed for those who already have a fundamental understanding of CMMI concepts, who wish to develop a deeper understanding of CMMI models, and who are planning to become CMMI instructors or SCAMPI Lead Appraisers
- SCAMPI Lead Appraiser[SM], designed to prepare those who have appraisal experience and wish to become authorized leaders of SCAMPI appraisal teams—SCAMPI Lead Appraisers—in the SEI Appraiser Program
- CMMI Instructor Training, designed for those who wish to teach the Introduction to CMMI courses

CMMI Product Suite Gaining Widespread Adoption

The SEI offered customized support services to organizations that are actively pursuing the adoption of the CMMI Product Suite:

- SEI staff members participated in CMMI adoption/improvement efforts with the following organizations: Army Aviation and Missile Command (AMCOM), BAE Systems, Computer Resources Support Improvement Program (CRSIP), Defense Finance and Accounting Service (DFAS), Harris Corporation, Internal Revenue Service, Joint Simulation System (JSIMS), Marconi, Military Satellite Communications (MILSATCOM), NASA, Social Security Administration, Telephonics Corporation, U.S. Coast Guard Deepwater Program, U.S. Department of Education, and Warner Robins Air Logistics Center.

- DoD contractors continue to adopt the CMMI Product Suite. Among the many contractors that have adopted CMMI are Lockheed Martin, Northrop Grumman, and Raytheon, as well as some DoD Service locations, such as the U.S. Army Communications-Electronics Command (CECOM), and the Naval Sea Systems Command (NAVSEA), Dam Neck.
- Among the many world-class non-defense commercial and government organizations that plan to adopt the CMMI Product Suite are Accenture Government Services, BMW, Boeing, Bosch, DynCorp, Ericsson, Fannie Mae, Fujitsu, General Motors, Hitachi, Honeywell, IBM Global Services, Infosys, Intel, KPMG, L3 Communications, Motorola, National Reconnaissance Office, NEC, Polaris, Reuters, Science Applications International Corp. (SAIC), Samsung, Wipro, and Zurich Financial Services.

Adoption of the CMMI Product Suite proceeded rapidly in FY2002, as shown in the chart below.

Total for All Years	Indicators of Adoption	Increase in FY2002
5,939	*People who have attended the Introduction to CMMI course offered by the SEI and its authorized transition partners (see page 67 for more about transition partners and licensing)*	*75%*
413	*People who have attended the Intermediate Concepts of CMMI Course*	*54%*
48	*Transition partners authorized to offer the Introduction to CMMI course*	*15%*
85	*Instructors authorized to teach the Introduction to CMMI course*	*118%*
84	*Transition partners authorized to offer SCAMPI Lead Appraiser services*	*63%*
142	*SCAMPI Lead Appraisers authorized to conduct appraisals*	*77%*

People Capability Maturity Model Version 2 Released

The SEI released Version 2 of the People CMM model as both a technical report[10] and a book in the SEI Series in Software Engineering,[3] published by Addison-Wesley. The People CMM Version 2 model incorporates the newest best practices related to workforce development and management, and supports and complements the CMMI Product Suite, including best practices that cover integrated product and process development.

Software Acquisition CMM Version 1.03 Released

Many organizations serve as acquiring, outsourcing, or buying agents for other enterprises. The Software Acquisition CMM[11] documents best practices in the acquisition of software-intensive systems. Version 1.03 incorporates feedback from users as well as the results of lessons learned from conducting appraisals and process improvement using Version 1.02.

COTS-BASED SYSTEMS

Few organizations today would consider building a system entirely from scratch. Use of commercial off-the-shelf (COTS) products offers the promise of faster time to market and an opportunity to take advantage of commercial investments in technology to increase the functionality and capability of systems.

But the promise of COTS products is too often not realized in practice. Many organizations find that COTS-based systems are difficult and costly to integrate, support, and maintain.

Organizations tend either to assume that COTS products can simply be glued together or to fall back on the traditional development skills and processes with which they are familiar—skills and processes that are ineffective in the development of a COTS-based system.

Purpose

The purpose of the SEI's work in COTS-based systems[12] is to overcome the difficulties of using, and misconceptions about, COTS products by ensuring that best engineering and management practices are employed when systems are built from commercial products and components. The SEI focuses on

- processes needed by acquirers and developers in the management, creation, and sustainment of systems constructed from COTS products
- engineering techniques for designing, evolving, and sustaining COTS-based systems
- evaluation techniques for assessing COTS-based program risks and for determining the suitability of COTS products and the appropriateness of COTS-based system designs
- the interconnection of the acquisition issues, business practices, and technical demands of engineering and evolving COTS-based systems

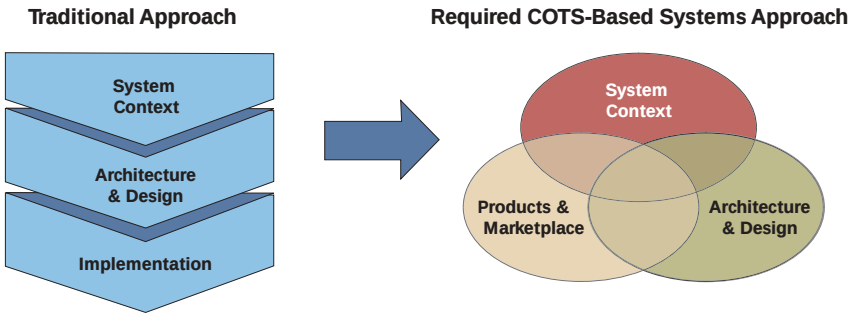
The COTS Usage Risk Evaluation (CURE), a two-day assessment that uncovers risks and provides mitigation strategies, is "painless, quick, and productive," according to Col David R. Chaffee, program director for the Combat Air Forces Command and Control Systems Program Office, Electronic Systems Center, Hanscom Air Force Base.

Accomplishments

COTS Usage Risk Evaluation℠ (CURE℠) Version 2.0 Released

In any acquisition that will include extensive use of COTS products, several problems emerge. For example, the requirements process must become more flexible, yielding to the realities of commercial products, such as the inability to control when products are released, the features they include, and their ability to interface with other products. Such problems contribute to a program manager's loss of control and create added risk.

To help manage these risks, the SEI developed the COTS Usage Risk Evaluation (CURE).[13] This two-day assessment involves site visits by SEI personnel to the program office and contractor for COTS-based acquisitions. Structured question-and-answer sessions are used to uncover potential risks in the acquisition. Risks are identified, and strategies for mitigating those risks are provided in a final briefing.



Use of COTS-based systems changes the focus of software engineering from one of traditional system specification and construction to one requiring simultaneous consideration of the system context (system characteristics such as requirements, cost, schedule, and operating and support environments), capabilities of products in the marketplace, and viable architectures and designs.

In FY2002, a major release of the CURE method (Version 2) was completed and used for four program evaluations. At the January 2002 DoD Software Collaborators Workshop (see page 45), Col David Chaffee, speaking from his experience with two CUREs at the Electronics Systems Center (ESC), had high praise, stating, "CUREs are painless, quick, and productive."

Evolutionary Process for Integrating COTS-Based Systems℠ (EPIC℠) Documented

For program managers and practitioners engaged in projects using commercial products, the Evolutionary Process for Integrating COTS-Based Systems (EPIC)[14] offers a comprehensive framework to follow. EPIC comprises a set of iterative activities and processes to build, field, and support a solution based on commercial products. EPIC was documented in two technical reports: an overview for those who want to understand EPIC principles and structure,[15] and a detailed description of the goals, activities, guidelines, and artifacts across the life cycle for COTS-based projects.[16]

SEI Helps Identify Contractor Strengths, Weaknesses

The SEI provided technical support directly to the manager of the Command and Control System Consolidation (CCS-C) program during proposal evaluation, helping to identify strengths and weaknesses of potential contractors. Support continued with reviews of the selected contractor's software development plan, detailed suggestions for improvement, and an offering of the SEI's COTS-Based Systems for Program Managers course. Lt Col Stephen D. Hargis, CCS-C Program Manager, wrote: "Bottom line is SEI has been a tremendous help to my program, and I look forward to continued support."

First International Conference on COTS-Based Software Systems Held

The first International Conference on COTS-Based Software Systems (ICCBSS), held in Orlando, FL, in February 2002, served to stimulate formation of a worldwide COTS-based systems community and generate widespread technical interest and participation. The conference was sponsored by the SEI, the National Research Council of Canada (NRC), and the University of Southern California Center for Software Engineering (USC-CSE). More than 175 people from four continents attended the conference, where 23 papers were presented (see page 46). ICCBSS 2003 was held in February 2003 in Ottawa, Canada. ICCBSS 2004 will be held Feb. 2–4, 2004, in Los Angeles.[17]

ICCBSS panel members: (from left) Will Tracz, Lockheed Martin; Tom Baker, Boeing; Anthony Earl, Sun Microsystems; and Tricia Oberndorf, SEI.

PERFORMANCE-CRITICAL SYSTEMS

Program managers need systems that can perform successfully under adverse circumstances—for example, under heavy loads or in the presence of subsystem failures. Yet the behavior of systems under such circumstances is often unacceptable. The critical need to manage performance is obvious in real-time systems, such as flight-control software. Likewise, unexpected performance problems in command-and-control or management information systems can make such systems virtually unusable until costly repairs are undertaken.

Purpose

The purpose of SEI work in performance-critical systems[18] is to help ensure that both the government and its contractors are aware of effective techniques for predicting and controlling critical aspects of system performance. In addition, because new techniques are evolving for controlling critical system-performance properties, the SEI is also committed to bringing the best of emerging practices into use on DoD systems.

Equally important are techniques for ensuring the robustness of systems even in the presence of software errors, unexpected patterns of use, and hardware failures.

In the coming year, the SEI will refocus this work on technology to address the DoD's increasing needs for highly dependable distributed and networked systems, as well as on survivability. The accomplishments specified in the next section reflect the focus in FY2002 on performance.

Accomplishments

Portable Operating System Interface Standard (POSIX) Supported

The SEI has been a key agent for the government in obtaining a standard for real-time distributed systems communication. An SEI staff member chaired the POSIX working group of the Institute of Electrical and Electronics Engineers (IEEE): Real-Time Distributed Systems Communications, Language Independent Specification. SEI staff members helped to develop and voted on the standard. Reballoting was completed in FY2002, and the standard was approved. POSIX 1003.21 will bring standardization for the UNIX community where none had previously existed and thus provide the potential for increased portability of software.

Navy DD(X) Program Supported

The SEI helped the Navy's DD(X) Program in the areas of system and software architecture by participating in technical reviews for a variety of DD(X) subsystems, including the multi-function radar (MFR) subsystem, and providing recommendations to the contractor and the program office. In addition, the SEI developed and presented a well-attended half-day tutorial for the entire DD(X) Program Office on performance-critical systems and software architecture. The SEI has been actively participating on the system architecture, software engineering, and executive review panels for the DD(X) Program Office Total Ship Computing Environment technical team.

The SEI is working with the Navy Program Office on the multi-function radar subsystem for the DD(X), the Navy's next-generation surface combatant ship.

The SEI is working with the Army on its Future Combat Systems, which include the Stryker Infantry Carrier Vehicle, shown rolling off a C-130 aircraft after being transported for a National Training Center exercise in Fort Irwin, CA.

Avionics Architecture Description Language Developed

The SEI is helping develop a standard for an Avionics Architecture Description Language (AADL), under the auspices of the Society of Automotive Engineers (SAE) Avionic Systems Division (ASD) and with funding from U.S. Army Aviation and Missile Command (AMCOM). The standard provides descriptive methods that permit the formal analysis of system-performance properties. The SEI has been an evaluator and user of the technology that underlies the standard, and a staff member is co-author and editor of the standards document.

The establishment of the AADL is having widespread impact. The standard itself is being aligned with the Unified Modeling Language (UML) to ensure an active practitioner community. Tutorials have been offered on AADL at SAE meetings and at the Digital Avionics Systems Conference. A recent tutorial and coordination meeting in Toulouse, France, was attended by 90 people from the avionics, aerospace, and automotive industries. This community is starting to investigate the incorporation of AADL into its real-time software engineering practices.

Future Combat Systems Program Supported

The SEI has been actively supporting the analysis of software issues for the Army's Future Combat Systems (FCS) program. The FCS program is in its early phase of concept and technology development, when improved software-development methods can have maximum impact. Initial activities have included evaluation of the software-development plan and the proposed FCS architecture.

This effort involved collaboration with the Center for Empirically Based Software Engineering (CeBASE). Principal collaborators were drawn from the University of Maryland, the Fraunhofer Center–MD, and the University of Southern California Center for Software Engineering.

PREDICTABLE ASSEMBLY FROM CERTIFIABLE COMPONENTS

Significant economic and technical benefits accrue from the use of pre-existing and commercially available software components to develop new systems. However, variable component quality, combined with hidden component behavior, has forced system developers to rely on extensive prototyping just to establish the feasibility of using a component in a particular assembly. Predictability is difficult to attain. Many of the benefits of software component technology evaporate in the presence of high design uncertainty and low consumer trust in components.

Purpose

The Predictable Assembly from Certifiable Components (PACC) project,[19] which began as an independent research and development project in FY2002 (see page 37), was begun to determine whether, and how, the twin objectives of design predictability and component trust could be achieved. A software development activity is predictable if the runtime behavior of an assembly of components can be predicted from the known properties of components and if these predictions can be objectively validated. A component is certifiable if these known properties can be ascertained and validated by independent third parties.

In 2003, the SEI will provide seminal technology to certify software components for predictable assembly and to open up a new world of trusted software components. This will be accomplished by ensuring that the builders of systems can select software components on the basis of their predicted runtime behavior within specific assemblies.

Predictable: *System properties can be predicted based on component properties.*

Assembly: *Systems can be assembled from components, which could come from third parties, in a way that preserves predictions.*

Certifiable: *The properties of components are trusted and provide a basis for trust in component and system predictions.*

Components: *The components have interfaces that fully describe their externally visible properties.*

The SEI is working with ABB on the next generation of software for use in automating electrical substations.

The SEI's approach to PACC rests on prediction-enabled component technology (PECT). At the highest level, PECT is a scheme for systematic and repeatable integration of software-component technology, software-architecture technology, and design analysis and verification technology. The results of this integration are engineering methods and a supporting technical infrastructure that together enable PACC.

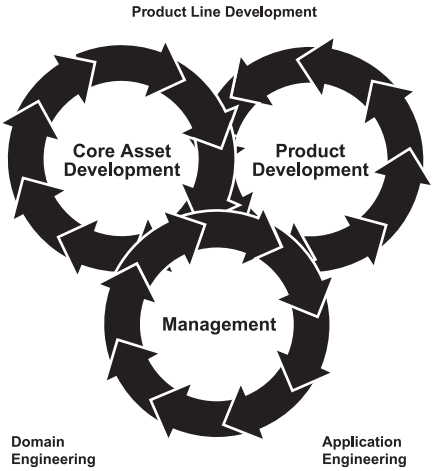
Accomplishment

Model Problems Research Leads to Solutions

In FY2002, the SEI collaborated with ABB Ltd.'s Corporate Research Center to undertake a two-year feasibility study of predictable assembly for substation automation systems within the domain of power transmission and control. To conduct this feasibility exploration, the SEI and ABB defined a series of model problems, simplifications of more complex problems whose solutions can be extrapolated to real problems.

Software and electronics are two critical areas that require increased attention from Congress and the DoD, former Congressman Dave McCurdy said in testimony before the House Armed Services Subcommittee on Military Procurement. McCurdy, president of the Electronic Industries Alliance, made the case for "a new paradigm for software engineering that moves engineering analysis to the forefront," and cited SEI technical work: "There is already very interesting and important work going on in this regard, known as Predictable Assembly from Certifiable Components. These efforts need greater attention and support from government and commercial buyers alike." A well-respected industry voice, McCurdy stressed the need for more research to improve the practice of software engineering.[20]

PRODUCT LINE PRACTICE



An important role of the SEI is to help the DoD and the software engineering community adopt cutting-edge software-development practices. One such practice is the use of a product line approach for software. Long a practice in traditional manufacturing, the concept of product lines is relatively new to the software industry.

Organizations developing software-intensive systems face many challenges, such as long development cycles, low return on software investments, and difficulty in software system integration. A product line approach to software can overcome these challenges.

Traditionally, software-intensive systems have been acquired, developed, tested, and maintained as separate products, even if these systems have a significant amount of common functionality and code. Such an approach wastes technical resources, and takes longer and costs more than necessary. Using a product line approach, each product is formed by taking applicable components from a base of common assets, tailoring them as necessary through planned variation mechanisms, adding any new components that may be necessary, and assembling the collection according to the rules of a common, product-line-wide architecture. Building a new product or system becomes more a matter of assembly or generation than creation, of integration rather than programming.

Organizations of all types and sizes are discovering that a product line strategy, when skillfully implemented, can yield enormous gains in productivity, quality, and time to market. Making the move to product lines, however, is a business and technical decision, and requires considerable changes in the way organizations practice software engineering, technical management, and organizational management.

The SEI is helping organizations adopt a software product line approach by defining the concepts, practices, activities, and guidance that ensure success.

Product line developments are becoming increasingly commonplace in the true commercial world...I strongly recommend that you obtain a copy of a new book,* Software Product Lines: Practices and Patterns, *just published in 2002 by Addison-Wesley.

Lloyd K. Mosemann II
Senior Vice President for Corporate Development, Science Applications International Corp. (SAIC), from the keynote speech he delivered at the Air Force-sponsored Software Technology Conference in Salt Lake City, UT

Purpose

The purpose of the SEI's work in software product lines[21] is to

- enable developers and acquirers to exploit the demonstrated commercial benefits of software product line practice
- promote the growth and maturation of techniques for finding and exploiting system commonalities and for controlling variability, and ensuring that those techniques become standard software engineering practice in the DoD and industry
- make product line development and acquisition a low-risk, high-return proposition

Accomplishments

Product Line Framework Refined

During FY2002, the SEI incorporated the latest practices and real-world experiences into revised editions of its fundamental product line resources: Version 4.1

of the *Framework for Software Product Line Practice*SM,[22] which provides a comprehensive description of the essential activities and practices necessary for software product line success; and Version 2.0 of *Software Product Line Acquisition: A Companion to a Framework for Software Product Line Practice*,[23] which provides the additional insights needed in a DoD acquisition environment.

In addition, the SEI refined the Product Line Technical Probe℠ (PLTP℠), the instrument for diagnosing an organization's product line readiness, to include the concept of product line practice patterns. Patterns are a way of expressing common contexts and problem and solution pairs, in this case relative to a software product line effort. The patterns help organizations more readily understand their diagnosis and plan needed action.

To further assist organizations that have already undertaken software process improvement, the SEI published a comparison of the *Framework for Software Product Line Practice* to the CMMI® framework.[24]

Software Product Line Course Introduced

The SEI introduced a new two-day course, Software Product Lines: Practices and Patterns, based on the book by the same name. The course is useful for anyone involved in or contemplating a software product line, and attendees in 2002 gave the course high ratings. This course was piloted in FY2002 and will be among the SEI's public courses in FY2003.[6]

SEI Hosts Fifth DoD Product Line Practice Workshop; Second Software Product Line Conference

The SEI sponsored and organized the Fifth DoD Product Line Practice Workshop. Participants included representatives from U.S. military services and a variety of defense contractors. Presentations at this workshop included "Product Lines for DoD Open Air Ranges," which detailed the success of a Navy product line, Rangeware; and "Acquisition of a Product Line for Army Live Training" and "Development of a Product Line Architecture for Army Live Training," which described an Army product line from the perspectives of the acquirer and the contractor.

Growth of the software product line community is critical to widespread product line practice. The DoD workshop was one of nine focused product line workshops organized by members of the SEI technical staff during 2002 and was held in conjunction with the Second Software Product Line Conference (SPLC2, see page 47).

More Organizations Adopt Product Line Approach

More product line success stories are emerging in both industry and the DoD. The SEI has collaborated directly on some, including the Naval Underwater Warfare Center's Rangeware product line asset base that supports test, training, and evaluation missions at major ranges. Currently there is one system from the product line in operation at the Atlantic Undersea Test and Evaluation Center and two ready to go live. There are three more systems in various stages of planning that will definitely use Rangeware and another five to eight programs that are candidates for employing product lines.

Other organizations, including Cummins, Raytheon, Robert Bosch GmbH, and Salion report using the SEI's *Framework for Software Product Line Practice* as a reference model in their efforts. These efforts further validate the benefits of software product lines and the approach's viability in the DoD.

The product line patterns are the heart and the most condensed experience of the SEI's* Framework for Software Product Line Practice*...The patterns are specific processes that help to achieve only certain goals in a pre-defined environment. Though I think the [Framework] patterns can be improved and extended, they are much more meaningful to the product line community than any other product line process description I have seen up to now.

Stefan Ferber
Robert Bosch GmbH

July/August 2002 Issue of *IEEE Software* Dedicated to Software Product Lines

Two SEI staff members were guest editors of this issue: Linda Northrop, program director of the SEI's Product Line Systems Program, and John McGregor, an SEI visiting scientist. Highlights of this issue included three articles written by SEI staff members: "Software Product Line Tenets," "Feature-Oriented Product Line Engineering," and "Being Proactive Pays Off."

SOFTWARE ENGINEERING MEASUREMENT AND ANALYSIS

As software projects continue to grow larger and more complex, management and control of those projects remains problematic. Cost overruns, late deliveries, and poor-quality products plague developers and acquirers of software-intensive systems in both the defense and commercial sectors. Additionally, the new technologies flooding the market must be evaluated for their benefits and effectiveness. One way to improve this situation is to develop and use measurement techniques and credible information sources for evaluation, benchmarking, and process improvement.

Purpose

The purpose of SEI work in measurement and analysis[25] is to provide analysis guidance, information resources, and practices that help DoD and industry suppliers of software-intensive systems apply quantitative management techniques to improve their projects, processes, and organizations.

Measurement and analysis techniques provide the data organizations need to track efforts to improve software processes, lower costs, and reduce defects, and provide valuable information about returns on investments. From introducing basic measurement principles to helping high-maturity organizations introduce statistical process control and improvement methods, the SEI provides the level of guidance necessary to produce meaningful, cost-saving results.

We are extremely pleased with the timely support [the SEI] provides in the areas of measurement and analysis, organizational process performance, and quantitative project management.

Millee Sapp
Software Engineering Process Group Lead, Warner Robins Air Logistics Center

Accomplishments

Methods Developed to Reconcile CMM, Six Sigma

The SEI, in conjunction with industry collaborators, is leading the way in the application of Six Sigma methods for software. Six Sigma methods are common in organizations that manufacture software-intensive products. Many of these organizations have already implemented software process improvements based on the Capability Maturity Model® (CMM®), but are struggling to align these efforts with manufacturing-based improvement processes such as Six Sigma. In response, the SEI has developed various software process improvement and statistical analysis techniques using Six Sigma methods, an innovation that is yielding significant results. Using these methods, organizations can develop indicators and measures to track customer satisfaction, cost and schedule, defect detection, and other elements of business performance.

During FY2002, these techniques were described by SEI staff members at the International Council on Systems Engineering (INCOSE) conference and coupled with CMMI® process improvement efforts at Warner Robins Air Logistics Center in Georgia. There, the SEI is applying both goal-driven software measurement and Six Sigma methods to help Warner Robins achieve the goals of the Measurement and Analysis and the Quantitative Project Management process areas of the CMMI Product Suite.

Software Engineering Information Repository Reaches 17,000 Members

The exchange of best practices and lessons learned is at the heart of the SEI's mission. The SEI operates an online resource to disseminate information about software engineering practices and technologies: the Software Engineering Information Repository (SEIR), available at http://seir.sei.cmu.edu. Software professionals can support their acquisition and development efforts by utilizing this resource for detailed information on a variety of software technologies.

The SEIR is a forum for software engineers from government, industry, and academia to exchange lessons learned, pose questions, and submit materials that might help others to adopt improvement approaches. The SEIR also provides information showing the impact of software engineering improvement methods on organizational performance. Since its inception in 1998 with 104 users and minimal site content, the SEIR has grown to become one of the most frequently visited Web sites operated by the SEI.

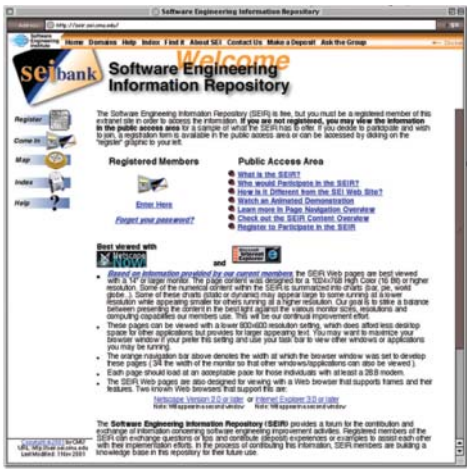
One component of the SEIR is the Process Appraisal Information System (PAIS). The PAIS provides the findings and data to support the publication of the Process Maturity Profiles of the Software Community.[26] The maturity profiles characterize the software community in terms of its software process maturity and common process strengths and weaknesses. They are based on results from more than 2,000 process assessments and present information on organization type, size, maturity, and other factors. Nearly 80,000 copies of the maturity profile were downloaded in 2002. The profile is published in March and September every year.

Defect Prediction Model Developed

During FY2002, the SEI and the United Space Alliance collaborated successfully on the topic of capture–recapture (CR) models, developing a prediction model for estimating defects after design or code inspections were conducted on the Space Shuttle. The flight software on the Space Shuttle consists of more than 400,000 lines of code. The completed prediction model combined the CR estimate with size and inspection data to provide a reinspection decision accuracy of 80%—a considerable improvement over previous decision-making accuracy. To date, this has been the largest dataset of actual inspections analyzed with the use of CR models.

Goal-Driven Measurement Techniques Gain Proponents

The SEI's goal-driven measurement techniques were applied at several Defense Finance and Accounting Service (DFAS) sites. An SEI staff member developed and delivered a measurement workshop to DFAS corporate management in Kansas City, focusing on reusing existing DFAS measurements, rather than starting from scratch. DFAS management is now working independently to develop its own measures and indicators to guide its work. The goal-driven measurement techniques were also taught to practitioners at the Center for Medicare and Medicaid Systems (CMS). Furthermore, these techniques were incorporated into a tutorial on organizational performance measurement that was offered multiple times as part of Carnegie Mellon's CIO Institute curriculum.



This year the SEIR has grown to include 17,000 members, representing nearly 5,000 organizations in 80 countries, and it includes more than 10,300 Web pages and 450 documents.

SURVIVABLE SYSTEMS

The phenomenal growth of the Internet has spawned a global information society. The Internet connects an estimated 162 million computers in 240 countries and territories. Businesses with highly distributed information assets can function internationally with great efficiency, exchanging information quickly among their divisions, partners, suppliers, and customers. Governments are increasingly using the Internet to provide services to their citizens and for international information sharing and collaboration. Scientists, engineers, and educators all use the Internet for collaboration and rapid dissemination of information. Critical national infrastructures supporting such vital areas as power, transportation, and defense are growing more dependent on Internet-based applications.

Use of the Internet, however, puts the networked systems of these organizations at serious risk of compromise as a result of cyber attack. Attack tools are increasingly automated and sophisticated. The number of vulnerabilities discovered in widely used commercial software continues to more than double each year. Organizations relying on the Internet face significant challenges to ensure that their networked computing systems are survivable—that they provide essential services in the presence of attacks and failures, and recover full services in a timely manner.

Purpose

Through its work in survivable systems,[27] the SEI seeks to ensure that management practices and technology are available to help organizations recognize, resist, and recover from attacks on networked systems. In particular, the SEI supports improvement in the security of networked systems by

- developing and transitioning survivability engineering practices to software acquirers and developers, practices that focus on security and survivability as explicit requirements and yield systems with built-in mechanisms to recognize, resist, and recover from attack
- developing and transitioning secure programming practices and tools for discovering and eliminating the most common cause of security vulnerabilities: implementation errors that can be exploited to compromise systems
- developing and demonstrating the effectiveness of modeling and simulation tools that can be used to model and predict security attributes of systems while they are under development and to identify the cascade effects of attacks and failures
- maturing operational tools for early detection and effective management of threats to networked systems
- providing a comprehensive view of attack methods, vulnerabilities, and the impact of attacks on information systems and networks and on the operations that they support; also, advising the DoD on incident and vulnerability trends and characteristics. This support is provided by the CERT® Coordination Center (CERT/CC, see page 31).
- building an infrastructure of increasingly competent security professionals who respond quickly to attacks on Internet-connected systems and who are able to protect their systems against security compromises
- developing training courses that improve the skills of network system administrators to respond to attacks and to prevent security compromises
- developing and transitioning methods to evaluate, improve, and maintain the security and survivability of deployed mission-critical organizations and systems
- working with vendors to improve the security of as-shipped products

Richard D. Pethia, director of the SEI's Survivable Systems Initiative, is frequently asked to provide Congressional testimony on cybersecurity issues, and is a frequent speaker at software and security conferences.

CERT® COORDINATION CENTER (CERT/CC)

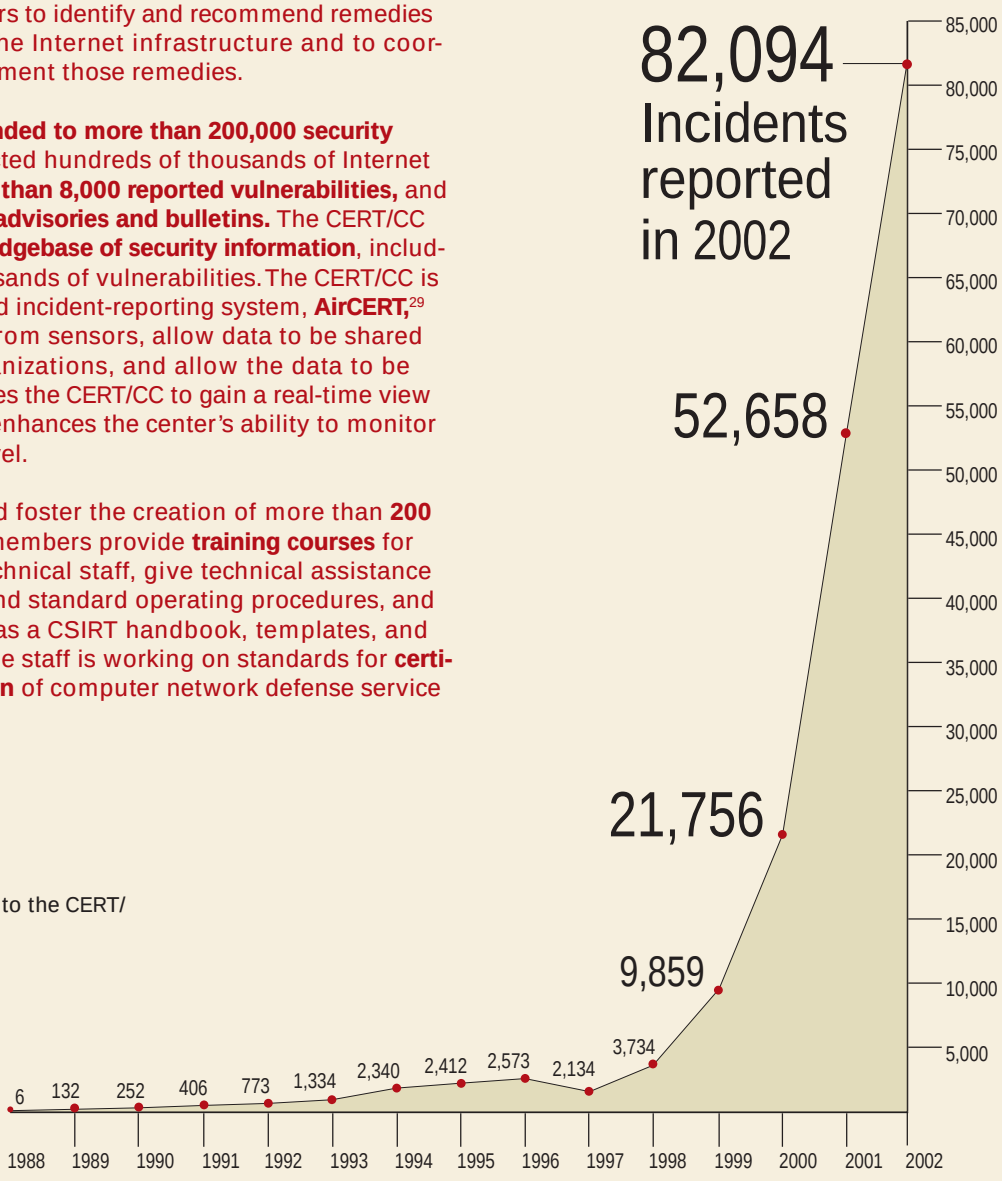
The CERT Coordination Center (CERT/CC)[28] was established in 1988 as **the first computer security incident response team (CSIRT).** Staff members provide technical assistance and coordinate responses to security compromises, identify trends in intruder activity, analyze vulnerabilities in products and systems connected to the Internet, and work with vendors and other security experts to identify solutions to security problems. **They alert the Internet community** to potential threats to the security of their systems and provide information about how to avoid, minimize, or recover from the damage. CERT/CC technical experts are routinely called on by their sponsors and by **international and homeland security** leaders to identify and recommend remedies to security problems in the Internet infrastructure and to coordinate activity to implement those remedies.

The CERT/CC **has responded to more than 200,000 security incidents** that have affected hundreds of thousands of Internet sites, **has handled more than 8,000 reported vulnerabilities,** and **has issued hundreds of advisories and bulletins.** The CERT/CC also **maintains a knowledgebase of security information**, including descriptions of thousands of vulnerabilities. The CERT/CC is developing an automated incident-reporting system, **AirCERT,**[29] which can collect data from sensors, allow data to be shared within and among organizations, and allow the data to be sanitized. AirCERT enables the CERT/CC to gain a real-time view of incident activity and enhances the center's ability to monitor changes in the threat level.

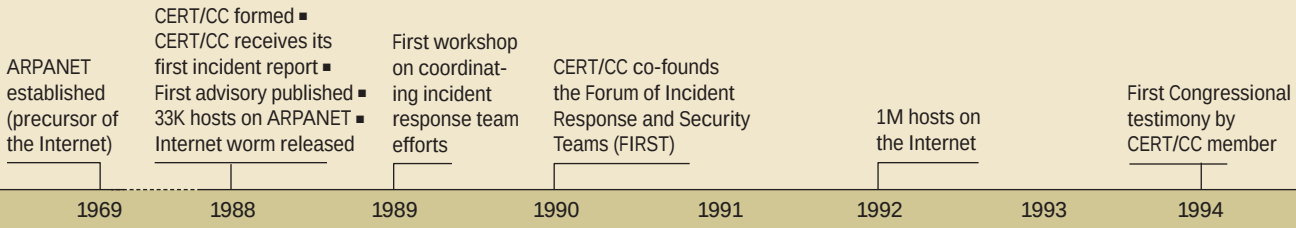
The CERT/CC has helped foster the creation of more than **200 CSIRTs**. CERT/CC staff members provide **training courses** for CSIRT managers and technical staff, give technical assistance by reviewing policies and standard operating procedures, and publish materials such as a CSIRT handbook, templates, and checklists. In addition, the staff is working on standards for **certification and accreditation** of computer network defense service providers and CSIRTs.

CERT routinely publishes security vulnerabilities and fixes. … By providing only a summary description of a vulnerability, but a detailed fix, CERT reduces the danger of hacking attempts based on this information. However, not all security watchdog organizations are so responsible. This situation has spurred debates regarding how much information on vulnerabilities should be published—and when.

Network Magazine, "Strategies & Issues: Ports of Entry—Routers in the Crosshairs," April 5, 2002.[30]



Security incidents reported to the CERT/CC since 1988.



SURVIVABLE SYSTEMS DEVELOPMENT TIMELINE

SEI's responsiveness has been exceptional. We added a number of new business lines to our services during the assessment process and SEI was able to help us develop appropriate protection strategies that would help us develop these services. The quality was excellent. The analysts that worked with us were amazing and we were completely impressed.

Roopangi Kadakia
Director
Systems, Security & New Technology

Office of Citizen Services and Communications

United States General Services Administration

Accomplishments

Response to SNMP Vulnerabilities Coordinated

The CERT/CC staff conducted an extensive coordination effort in response to vulnerabilities in the simple network management protocol (SNMP), a widely deployed protocol that is commonly used to monitor and manage network devices. Staff members contacted more than 280 vendors, many of whom interacted with the CERT/CC for the first time. More than 150 vendors responded to the problem, contributing a record number of vendor statements for a CERT/CC advisory (CA-2002-03)[31] and enabling the Internet community to protect itself. The day after the advisory was released, it already had been viewed more than 100,000 times, and the mailing list that the CERT/CC specifically created for the SNMP vulnerabilities had more than 400 subscribers. In the following week, CERT/CC staff members conducted 26 interviews with news media, helping to raise awareness of the problem. Articles appeared in publications such as *The New York Times*, *Business Week*, and the *San Francisco Chronicle*.

OCTAVE Method and Training Developed

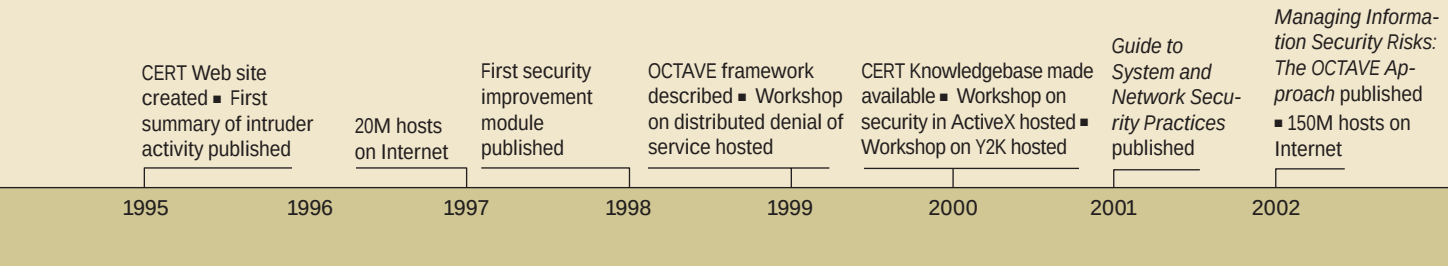
The SEI developed the Operationally Critical Threat, Asset, and Vulnerability Evaluation℠ (OCTAVE℠) method,[32] a self-directed approach for evaluating information-security risks. The results of this development effort were published in July 2002 in book form in *Managing Information Security Risks: The OCTAVE Approach*[33]. OCTAVE is endorsed by the Security Working Integrated Project Team, Office of the Assistant Secretary of Defense/Health Affairs, as the preferred security risk assessment for the DoD medical community to use in their preparations for complying with the forthcoming Health Insurance Portability and Accountability Act (HIPAA).

The SEI also developed OCTAVE-S, an information-security assessment technique for small defense manufacturers (see page 41).

Finally, the SEI made considerable progress in enabling others to use OCTAVE. More than 1,000 copies of the *OCTAVE Method Implementation Guide* were distributed and a public training course was offered four times to individuals and teams during 2002. In addition, the first OCTAVE Users' Forum was held in September 2002 in Washington, DC (see page 46).

e-Authentication Risk and Requirements Analysis Developed

The SEI has partnered with the General Services Administration Office of Electronic Government to develop the e-Authentication risk and requirements analysis (e-RA) approach, which helps organizations identify authentication risks and develop authentication requirements. The approach is being used by the 24 federal electronic government initiatives to define standardized levels of authentication and to define requirements for an authentication gateway—a single authentication solution for electronic government initiative users.



Training and Education in Information Security Offered

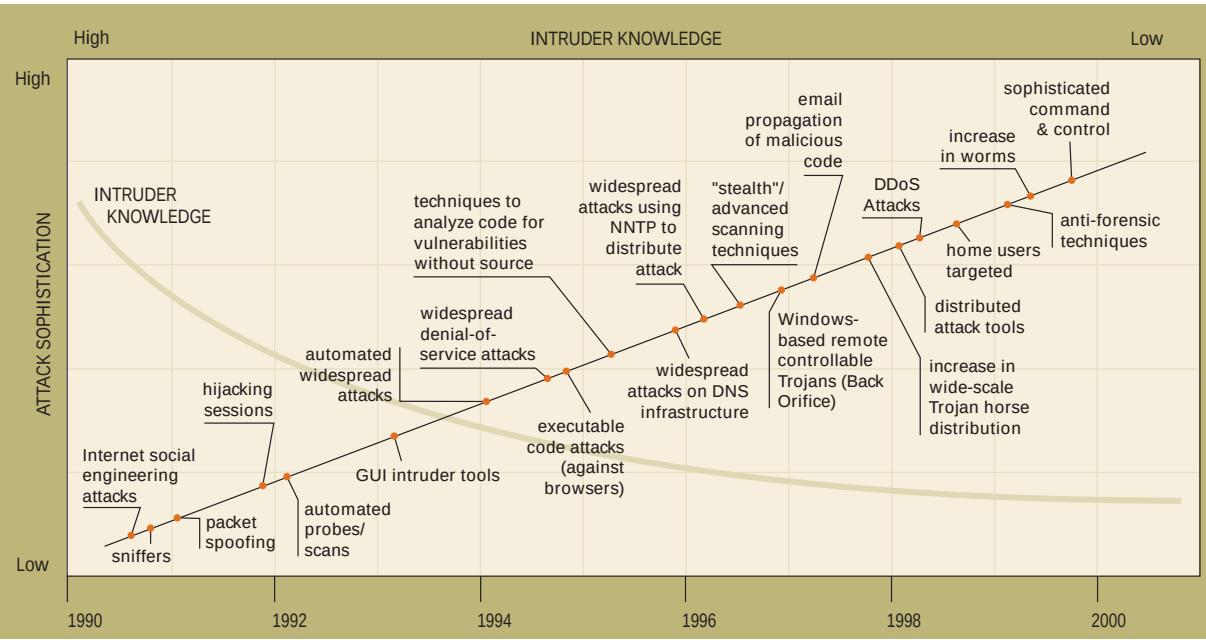
SEI staff members provided training and education that helped increase the number of trained professionals available to address security in networked computing. The SEI and its licensees offer nine courses related to computer and network security.[6] One example is a training course in network security and survivability developed for officers at the Marine Corps Command and Control System School as part of its curriculum on information technology (IT) networking. In the course, security, technologies, and recommended practices are covered at increasing layers of complexity, from concepts to technical implementations. The approach used in the course makes it appropriate for a broad range of IT professionals. It has been transitioned to the Air Force and offered as a public course at the SEI, and it has also been licensed for delivery by an international transition partner.

A second example is a four-week program aimed at increasing the number of PhD-level faculty and researchers in information security at historically black colleges and universities and Hispanic-serving institutions. Carnegie Mellon's School of Computer Science and the SEI are working with Howard University, Morgan State University, and the University of Texas at El Paso. The program provided participants with the knowledge and expertise to develop and deliver curricula in information security. As a result, PhD computer scientists will be able to teach courses in information security to advanced undergraduate and first-year graduate students at the participating universities.

These two efforts help build expertise among current IT professionals and create the next generation of Internet security experts.

I would like to express our appreciation for the professional job that you all did on the [network security and survivability] course. The students here loved the information in the student workbook as well as the hands-on provided by the lab exercises. We got great compliments on the course and the students are insistent on getting a copy on CD so they can read the "book" on their own.

Capt John Yarger
U.S. Marine Corps
Command and Control System
School, Instructor Group Coordinator



Increases in the sophistication of attack tools require decreasing intruder technical knowledge.

GUI: graphical user interface
NNTP: network news transport protocol
DNS: domain name system
DDoS: distributed denial of service

TEAM SOFTWARE PROCESS

Software organizations are under growing pressure to produce high-quality, reliable, and secure software products, but they must do so with fewer resources, lower costs, and predictable schedules. Yet the problems that have plagued the software industry for the past 50 years persist. Development and ownership costs continue to increase; delivery schedules are still unpredictable; and the defect count in software is still high, raising concerns about dependability and security.

The SEI is leading the way in helping software organizations solve these persistent problems, and the SEI's Team Software Process℠ (TSP℠)[34] is a key part of the solution. In project after project, the TSP approach has produced outstanding results for both DoD and commercial organizations, at all maturity levels. With a fast and repeatable deployment strategy that provides quick, substantial results, the TSP is transforming the culture and practices of software development teams.

Success came because of the team's ability to change paradigms by abandoning the old way of doing business and implementing PSP/TSP.

Chris Rickets
NAVAIR AV-8B lead software engineer and TSP design manager

Purpose

Through the TSP approach, the SEI is making fundamental changes to the practice of software development, moving the profession toward engineered solutions that are predictable, cost effective, timely, reliable, secure, and defect free. The TSP approach enables teams of software developers to work successfully with the Personal Software Process℠ (PSP℠), by which developers learn to plan, measure, and manage their personal development processes. The PSP approach provides the discipline, skills, and performance data that developers need to work in teams. The TSP builds on the PSP discipline to empower teams and change software practices within projects. Using the TSP, self-directed teams make their own plans and commitments, gather data for tracking their work, and manage the quality of the products they produce. The TSP approach also transforms software-management practice. TSP management training introduces software managers to a rational management style in which team data and coaching help teams achieve their best performances.

The TSP has been used in a broad range of commercial, industrial, and military software projects, with excellent results. On average:

- Cost and schedule deviation has been reduced to less than 10%.
- Delivered product quality has improved, with at least five times fewer defects.
- The times for system and acceptance testing have been reduced by five or more times.
- Project productivity improvements have been measured at 50% or better compared to similar projects.

Accomplishments

TSP Accelerates Process Improvement

The Naval Air Systems Command (NAVAIR) AV-8B Joint Systems Support Activity, which develops, acquires, and supports the aircraft and related systems used by the U.S. Navy and Marine Corps, is using TSP to accelerate CMM®-based process improvement. Using TSP, the AV-8B team jumped from Maturity Level 1 to Level 4 in just 30 months. Most organizations take an average of six years to achieve Level 4. During FY2002, the SEI performed a gap analysis between PSP/TSP practices and recommended practices in the Capability Maturity Model for Software, Version 1.1 (SW-CMM V1.1). The analysis showed that the TSP addresses a majority of SW-CMM practices, and allowed the AV-8B teams to focus their improvement efforts.

ABB Project Summary Showing TSP Results Compared to Industry Averages

	ABB's First TSP Project	*Industry Average*
Schedule variance	***6.9%***	***68% of projects are late by more than 20% or are cancelled[a]***
Effort in system test	***4.3%***	***Not available***
Schedule in system test	***12.9%***	***40%[b]***
System test defect density	***.44 defects/KLOC***	***5 defects/KLOC[b]***

[a] Reference: The Standish Group[1]
[b] Reference: Humphrey, W. *Winning With Software: An Executive Strategy*

TSP Improves Delivery, Reduces Defects

The SEI is helping ABB Ltd., one of the world's leaders in power and automation technologies, improve its software quality. ABB's first TSP project team was launched in late August 2001. The 62-week project was delivered within 6.9% of the original schedule (see table above). The team used PSP/TSP planning and tracking methods to meet the schedule. Equally impressive was the quality of the system that the ABB team produced. During system testing, only .44 defects were found per thousand lines of source code (KLOC). This represents a 10-times reduction in system test defects compared to a previous project completed without using the TSP. The team relied on TSP quality-management practices to achieve these results, removing defects early in PSP personal reviews and TSP team inspections. These practices saved time by reducing test effort to about 4% of total project effort.

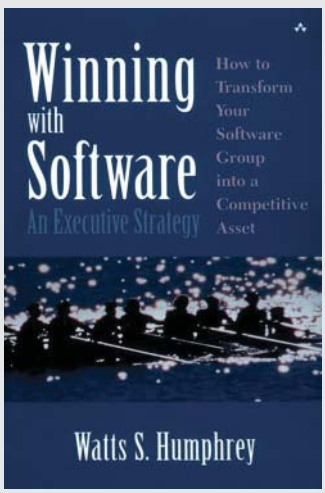
Transition of TSP Gains Momentum

The transition of the TSP into widespread use depends on the establishment of an infrastructure of capable individuals and organizations who are trained by the SEI to introduce the TSP and PSP. To this end, the SEI has trained and authorized more than 200 PSP instructors since 1995. Since October 2000, the SEI has trained more than 50 TSP launch coaches in more than 25 organizations.

Book, Seminar Provide TSP Training for Executives

During FY2002, the SEI explored new ways for helping executives understand and benefit from the business side of software. A new book by Watts Humphrey, *Winning with Software: An Executive Strategy*, introduced senior management to a seven-step process for using TSP to revolutionize software teams, improve quality, and cut costs. Real-life experiences and analyses of industry data, presented at the proper level of detail for an executive audience, provide a compelling business case for implementing TSP. In addition, the SEI created a two-day TSP Executive Strategy Seminar[35] for executives and middle managers. The seminar explains the major concepts and benefits of TSP and describes how it can effectively motivate engineers and project teams.

The latest work by CMM pioneer Watts S. Humphrey, *Winning with Software,* was published by Addison-Wesley in FY2002.



SPECIAL PROGRAMS

INDEPENDENT RESEARCH & DEVELOPMENT

Through its independent research and development (IR&D) program, the SEI conducts feasibility studies to determine whether an area of software engineering warrants further development by the SEI.

The following feasibility studies were initiated in late FY2001 and continued in FY2002:

Agent-Based Architectures: Intelligent agents are critical to making global and local resource-allocation decisions that optimize the utility provided by resource-consuming services. This study examines the application of adaptive agent-based architectures for mobile devices.

Analysis of Enterprise Integration Applications: Enterprise integration can provide timely and accurate exchange of consistent information between business functions to support strategic and tactical business goals in a seamless manner. This project investigates whether breakthroughs are possible in integrating information systems across an enterprise.

Flow-Service-Quality Systems Engineering: Foundations for Network System Analysis and Design: This study investigates a unifying approach to large-scale network system analysis, specification, design, verification, implementation, and operation. The result is an emerging technology called flow-service-quality engineering. It focuses on complexity reduction and survivability improvement, and provides engineering and management foundations for network system development.[36]

Several feasibility studies were started late in FY2000 and continued into FY2002:

Fusion: This project studies the feasibility of multi-source data fusion for the predictive analysis of network intrusions. The goal is to identify and exploit data sources to gain insight into the likely targets and behaviors involved in network intrusions, so that defensive and preventive strategies can be devised.

Open-Source Software: This study examines open-source software development and management practices to determine their viability and applicability to DoD systems.

Predictable Assembly from Certifiable Components: This study addresses the fundamental challenge of building systems from components. This is now an SEI focus area (see page 24).

Quality Software Development @ Internet Speed: This study examines how Internet software is developed today, with particular emphasis on the development processes used by Internet companies and the extent to which these processes are different from traditional software-development processes.[37]

Learning from Software Development and Acquisition Failures: This project investigates how to prevent or reduce software-intensive system failures by detecting patterns and trends related to those failures.

Technology Change Management in High-Maturity Organizations: This project studies the practices used by high-maturity organizations to introduce software engineering innovations to determine which practices are most effective and how they might be captured for wider dissemination to other organizations.

These projects are described in detail in the SEI technical report *SEI Independent Research and Development Projects* (CMU/SEI-2002-TR-023).[38]

INVESTIGATING NEW AREAS OF WORK

One of this year's new focus areas, Predictable Assembly from Certifiable Components, began as an exploratory independent research and development (IR&D) project in FY2001.

INDEPENDENT TECHNICAL ASSESSMENTS

Through independent technical assessments (ITAs),[39] teams from the SEI uncover the root causes of problems affecting DoD software-intensive programs, providing recommendations that maximize a program's strengths and minimize and mitigate its risks. ITAs are objective, technical evaluations of software-intensive development or acquisition programs. They are typically initiated by the system program director, program executive officer, or other acquisition official.

ITA teams are composed of SEI staff members and visiting scientists with a mix of expertise, who conduct a series of interviews with program stakeholders and ultimately deliver a briefing and recommendations.

The SEI has performed many ITAs over the past five years on mission-critical systems for the DoD and other agencies. Most of the programs evaluated have been U.S. Air Force and Navy programs, and have been procurements of software-intensive systems with the following application-domain attributes:

- command, control, communications, and intelligence
- logistics support
- electronics testing and evaluation
- satellite ground control
- real-time vehicle electronics

ITAs conducted in 2002 included

- an independent technical and programmatic evaluation of the Standard Procurement System (SPS) Program. The SPS is an automated information system that supports procurement functions at all DoD procurement organizations. In May 2002, the SEI team worked with the SPS Program Office to assess the current status of specific key areas (user satisfaction, requirements, test, resources, quality, deployment, and contracts) identified in the SEI's initial technical probe of the SPS program. This revisit was accomplished through interviews with the program office and the contractor. The SEI team prepared and presented an annotated briefing on its findings and offered recommended actions for the program office.
- a detailed follow-up to last year's ITA of the Air Force's Military Personnel Data System (MilPDS). The MilPDS supports all personnel management functions, from recruiting to job assignment, and ultimately separation or retirement. The SEI is working with the program office to determine the progress since the recommendations from last year's two-day probe. The SEI will continue to assess the program's strengths, weaknesses, and risks, and to provide recommendations and guidance for the newly established program management office.
- an interim technical review of the Joint Mission Planning System (JMPS). In this ITA, the SEI assessed the progress of the JMPS based on recommendations from last year's ITA. The program director has also asked the SEI to work closely with the program to implement other recommendations.
- a joint government and industry review of the Deliberate and Crisis Action Planning and Execution Segment (DCAPES) program, which enables the Air Force to manage the movement and deployment of its personnel anywhere in the world. The team provided analyses and recommendations in the areas of system performance, interfaces, scalability, and system evolution.

The two troops you sent are exactly what the doctor ordered. BAE and my troops are really impressed with their UNIX competence. *Finally, the government sent us somebody who didn't just go in to eat our donuts!*

Col Christopher King of Electronic Systems Center/Combat Air Forces Command and Control (ESC/AC), regarding two SEI staff members who conducted an assessment of recurring problems with the Air Force Mission Support Systems (AFMSS) program and provided recommendations for long-term sustainment and evolution.

TECHNOLOGY INSERTION, DEMONSTRATION, AND EVALUATION (TIDE) PROGRAM

Like other sectors of the U.S. economy, the defense manufacturing base is evolving. Increasingly, product development is being outsourced to small manufacturing enterprises. In recent years, advances in software technology have led to dramatic improvements in manufacturing productivity. Small manufacturers, however, have typically been reluctant to utilize this new technology, as they often lack the information and resources required to implement it.

The goal of the SEI's Technology Insertion, Demonstration, and Evaluation (TIDE) Program,[40] initiated in May 2000, is to improve the profitability and efficiency of small manufacturers by helping them understand the business and technical processes of selecting and integrating commercial software technology.

Through the TIDE Program, the SEI helps small manufacturers apply advanced software engineering technologies by

- offering training and workshops in technology adoption, information security, and software selection
- demonstrating and documenting the return on investment of specific technologies
- promoting collaboration and communication among subcontractors, suppliers, prime contractors, and original equipment manufacturers
- providing an unbiased source of information on advanced software, tools, and technologies
- adapting existing commercial software technology and developing new software capabilities for use by small manufacturers, especially in the areas of computer-based design, engineering, modeling, simulation, and scheduling

The TIDE Program has been championed and supported by U.S. Rep. Mike Doyle of Pennsylvania, who has also supported collaborations between the DoD's Manufacturing Technology (ManTech) Program and Department of Commerce's manufacturing initiatives.

U.S. Rep. Mike Doyle (far left) has championed the TIDE Program, which has helped small manufacturers understand the business and technical processes of selecting and integrating commercial software technology.

Accomplishments

TIDE Demonstrates Benefits with Two Manufacturers

To explore and demonstrate how small manufacturers might benefit from collaboration with the TIDE Program, the program partnered with several companies in southwestern Pennsylvania. By implementing advanced engineering, modeling, scheduling, and simulation tools, the SEI enabled those companies to lower costs, increase capabilities, and improve performance, while also putting growth strategies in place.

One partner was the Carco Electronics Company, a manufacturer of multi-axis rotational devices for testing missile-guidance systems, employing 45 people. Its goals were, first, to meet market demand for faster deliveries, reduced costs, and improved product performance, and second, to expand into new markets and products. Carco worked with SEI personnel to achieve its first goal through adoption of advanced 3D computer-aided design (CAD) and computer-aided engineering (CAE) tools, and design-process revision. In the first year, Carco realized a cost savings of $135,000, resulting in the recovery of the initial investment in less than 12 months. The company also realized its second objective: it significantly reduced the level of electronic design and software design effort required for new product development. This was achieved with assistance from the SEI in the adoption of control-system modeling and simulation tools. The company saw dramatic reductions in control-system design costs, design errors, and total engineering cycle times. This project resulted in an additional $150,000 savings for Carco in the first year.

Mike Novikov of Carco Electronics (left) discusses the company's improvements with the SEI's John Robert. Carco saw dramatic reductions in control-system design costs, design errors, and total engineering cycle times. By adopting new tools and methods, and reducing effort on new product development, Carco saved $285,000 in its first year of participation with the SEI.

The SEI also worked with the Kurt J. Lesker Company, a manufacturer of ultra-high-vacuum components and systems, employing 230 people. Market pressures were forcing the company to migrate from providing components to providing systems. Existing 2D CAD tools were insufficient for the new systems business. With help from the SEI, the company adopted a 3D CAD tool, which resulted in dramatic reductions in engineering time and reduced rework time in manufacturing. Savings from adoption of the new CAD system are on track to achieve full investment recovery within 12 months.

The Kurt J. Lesker Company had another concern. Because it manufactures a large variety of components, finished inventory is maintained at a minimal level and parts are made to order. Scheduling a large number of unique pieces through a series of shared workstations has resulted in unpredictable bottlenecks, causing unacceptable delivery delays. The SEI is working with Carnegie Mellon's Robotics Institute to help the company implement a new manufacturing-execution system, as well as new scheduling and simulation software. The collaboration has enabled the SEI to offer business expertise in adapting the software to a small manufacturing firm, and provide guidance in metric definition and selection, data analysis, and return-on-investment calculations.

The TIDE Program supports the Department of Defense Appropriations Act of 2000, helping to "demonstrate the cost savings and efficiency benefits of applying commercially available software and information technology to the manufacturing lines of small defense firms."

OCTAVE for Small Businesses Provides Information-Security Management Practices

Most small manufacturing organizations have implemented information systems and networked computing to improve their productivity. Unfortunately, networked computing can expose small manufacturers to a variety of new risks, affecting the confidentiality, integrity, and availability of their critical information. Most current approaches for evaluating information-security risks focus on the needs of large organizations. A pragmatic approach designed for small organizations does not exist today, and the cost of outsourcing this function to external parties is often too high for those organizations to bear. Through the TIDE Program and the SEI's Survivable Systems Initiative (see page 30), the SEI is developing a small-business version of the Operationally Critical Threat, Asset, and Vulnerability Evaluation℠ (OCTAVE℠)[32] for evaluating and managing information-security risks, known as OCTAVE-S. (For more on OCTAVE, see page 32.)

TIDE Offers Conference and Workshops

The SEI created and held three technology workshops on the topics of managing risk in software technology adoption, achieving successful technology adoption, and engineering for small enterprises. The SEI also held the TIDE Conference in September 2002 (see page 49).

TECHNOLOGY TRANSITION PRACTICES

For many organizations that develop software, technology transition—the process of facilitating the acceptance and use of a new technology—is a challenging and often unmanaged activity. Researchers developing software-improvement technologies for software developers are realizing that the value or quality of their technologies alone does not ensure their acceptance and use. Software developers, who now more than ever recognize a mission-critical need to improve their software engineering practices, face a spectrum of adoption challenges as they seek to improve their skills, processes, products, and capabilities. And acquirers of software-intensive systems are seeking better, more cost-effective practices for deploying and fielding those systems so that risks to adoption and use are minimized and managed. Each of these is an example of the kinds of technology-transition problems that the SEI helps to solve.

Purpose

SEI staff members have developed methods to help those responsible for technology transition to answer these questions:

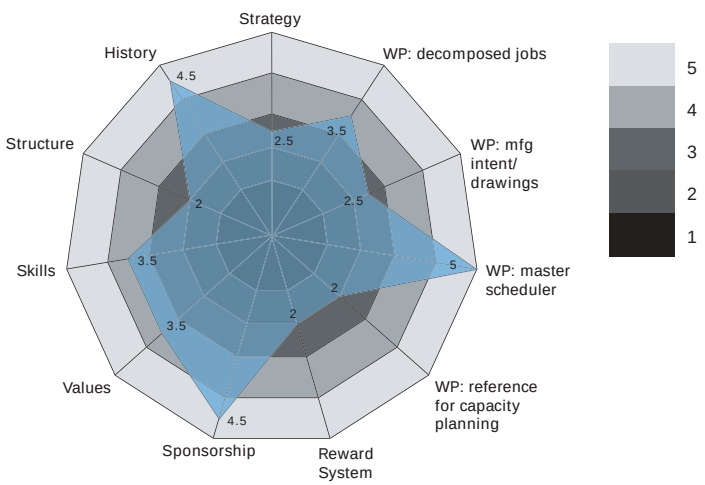
- Is the technology to be transitioned ready for the target community or organization?
- Is the target community or organization ready to adopt the new technology?

Many organizations do not ask these questions, do not know how to determine an answer, or do not know what to do next when the answer is "no."

SEI methods help organizations plan to overcome gaps and, ultimately, manage the transition to a successful completion. They are helping researchers, developers, and acquirers to better understand, evaluate, plan, and manage technology transition.

As of FY2003 (beginning Oct. 1, 2002), Technology Transition Practices (TTP)[41] was realigned at the SEI as part of the Technology Transition Services Directorate, which is charged with executing the SEI's amplify strategy (see page 5). Before this realignment, TTP was an SEI focus area called "Accelerating Software Technology Adoption."

Participants at the technology adoption workshops construct profiles of how ready their organizations are to adopt certain technologies. Diagrams such as this one result from participants responding to questions about the fit of the technologies they are proposing to adopt with relevant organizational characteristics and work practices (WP). The higher the number, the better the fit between the technology and the characteristic or practice.



Accomplishments

Evolutionary Acquisition Workshop Held

The SEI held a workshop, Building Implementation Strategies for Evolutionary Acquisition,[42] at the Program Executive Officer/System Commander (PEO/SYSCOM) Conference in October 2001 to assess the status of the acquisition community's transition to evolutionary acquisition (EA). The workshop was the best-attended tutorial at the conference. It focused on transition mechanisms—ways of disseminating information about and implementing EA. Workshop participants determined that mechanisms needed include technology readiness tools and techniques, discipline in the requirements process, and stabilization of funding across the life cycle. The workshop resulted in a letter of thanks from Dr. Nancy Spruill, Director, Acquisition Resources and Analysis, for the Office of the Under Secretary of Defense (Acquisition, Technology & Logistics), which read, "As a result of your work, the department has gained significant additional insight on how best to steer down the road ahead for Evolutionary Acquisition/Spiral Development."

Technology Adoption Workshops Held

SEI staff members provided a series of workshops to small manufacturing enterprises on the challenges of technology adoption. The workshops were part of the Technology Insertion, Demonstration, and Evaluation (TIDE) Program (see page 39), which was founded to encourage and assist small manufacturers in the adoption of commercially available software and information technology. The workshops presented information on supply-chain technology requirements, assessing technology-adoption readiness, and use of transition mechanisms to effect technology implementation, and described case studies of technology-adoption factors.

Technology Readiness Levels Study Conducted

In early 2002, the Communications Electronics Command Manager of the Army Tactical Wireless Network Assurance Science and Technology Objective (STO) requested help from the SEI in improving STO methods for assessing the maturity of new information-assurance technologies. The STO was seeking to use technology maturity, as measured by the technology readiness levels (TRLs) scale, as a metric in its decision-making process for selecting new technologies for STO development and maturation—technologies that would eventually be transitioned to Army tactical programs. SEI staff members helped conduct a study of the feasibility of using TRLs in STO technology screening, developing or acquiring a TRL tool, and implementing a TRL tool. Results of the study were reported in *Using the Technology Readiness Levels Scale to Support Technology Management in the DoD's ATD/STO Environments* (CMU/SEI-2002-SR-027).[43]

Technology Change Management Study Conducted

SEI staff members participated in a study of various aspects of technology change management (TCM). The purpose of the study was to examine the state of the practice of TCM, identify best practices and examples of effective applications, codify those practices and examples, and make them available. The study focused on how TCM is practiced at organizations that have achieved high levels of maturity against the SEI's Capability Maturity Model® (CMM®), many of which had appeared to be garnering competitive advantage through a strategic focus on TCM.

The Technology Adoption Workshop helped us to evaluate our behavior during a recent technology implementation project. We realized that we did not involve enough employees up front. We are doing a much better job now. The workshop helped us to determine when to involve others, helping us to save time and money.

Julie Crawford
Forrester Instruments

SEI CONFERENCES

DoD SOFTWARE COLLABORATORS WORKSHOP

January 22-24, 2002 **Arlington, Virginia**

This workshop for the acquisition community included presentations about the SEI technical program along with planning sessions with the DoD Software Collaborators, a network of providers of software research, services, and products that help program managers, software developers, and other DoD personnel.[44] With more than 85 people in attendance, the event provided the SEI with the opportunity to meet with DoD stakeholders to understand their needs and to discuss transition and adoption strategies, success criteria, and outcome metrics.

Relationships established at this workshop led to memoranda of understanding for collaborations with the MITRE Corporation, the Aerospace Corporation, and the Applied Physics Laboratory at Johns Hopkins University.

CMMI TECHNOLOGY CONFERENCE & USER GROUP

November 13-15, 2001 **Denver, Colorado**

Sponsored by the National Defense Industrial Association in conjunction with the SEI, this conference brought together the users, adopters, and developers of Capability Maturity Models® and those involved in internal process improvement to exchange ideas, concepts, and lessons learned. Special emphasis was placed on Capability Maturity Model Integration (CMMI®) implementation methodology and strategies, and the transition from the SW-CMM® and EIA/IS-731 to CMMI.

The keynote address, "CMMI: Improving the Acquisition of Defense," was given by Dr. Nancy Spruill, director of Acquisition Resources and Analysis, Office of the Under Secretary of Defense (Acquisition, Technology & Logistics). The 299 participants at the conference represented many groups, including defense, aerospace, and commercial companies; SW-CMM and CMMI transition partners; DoD and other government organizations; and small companies specializing in software and systems engineering development, tools, and processes.

INTERNATIONAL CONFERENCE ON COTS-BASED SOFTWARE SYSTEMS (ICCBSS)

February 4-6, 2002 **Orlando, Florida**

There were 175 attendees, representing 15 countries, at this event, which was sponsored by the SEI, the National Research Council Canada, and the University of Southern California Center for Software Engineering (USC-CSE).

ICCBSS[17] provided a unique sharing, learning, and networking opportunity in three days of tutorials, presentations, and panel sessions. Keynote speakers Ivar Jacobson of Rational Software Corp., Barry Boehm of the USC-CSE, David Baum of Motorola Labs, and Mike Moore of NASA Goddard Space Flight Center contributed their insights on lifecycle processes for COTS-based software systems, the use of component technologies, and evaluation of COTS products.

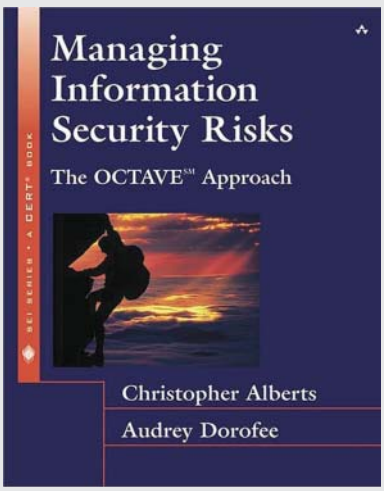
OCTAVE USERS' FORUM

September 19-20, 2002 **Arlington, Virginia**

This first OCTAVE[SM] Users' Forum, held at the SEI offices in Arlington, VA, included user presentations highlighting OCTAVE (Operationally Critical Threat, Asset, and Vulnerability Evaluation[SM]) field experiences and SEI presentations of new method artifacts and new directions in survivable enterprise management. Participation at this first meeting of the OCTAVE user community was by invitation only, with representatives from the DoD, federal civilian agencies, academia, and private industry attending.

Attendees met with other OCTAVE users to exchange lessons learned, implementation ideas, and ideas for tailoring the method. Participants included 37 people from such organizations as the General Services Administration, Department of Commerce, the U.S. Nuclear Regulatory Commission, and the Advanced Technology Institute.

Managing Information Security Risks: The OCTAVE Approach, published in FY2002, provides a coherent framework for aligning security actions with an organization's overall objectives.



SPLC2 Conference chair Linda Northrop with program co-chairs Henk Obbink (center) and Len Bass.

THE SECOND SOFTWARE PRODUCT LINE CONFERENCE (SPLC2)

August 19-22, 2002 **San Diego, California**

There were 157 attendees at this conference,[45] representing 17 countries from North America, Europe, Asia, and Africa. Most were from commercial organizations, but academia and government were also well represented. There was participation from leading software product line companies, including Hewlett-Packard, Nokia, Philips, Robert Bosch, Avaya, Motorola, Cummins, Siemens, Ericsson, Thales, and General Motors.

The conference program included seven tutorials; seven workshops, including one that was focused on DoD product line practice; an inspiring keynote talk, "Global Software Product Lines and Infinite Diversity," by Anders Heie from Nokia Mobile Phones; two panels; 24 technical paper presentations; four technical demonstrations; several birds-of-a-feather sessions; and the Second Software Product Line Hall of Fame, at which attendees voted in five new members to the software product line elite. This year's winners included Bell Labs/Lucent/AT&T's 5ESS, Cummins's diesel engine control-system product line, Philips's TSS, Market Maker Software's Merger product line, and Boeing's Bold Stroke avionics software.

SEPG[SM] 2002

SOFTWARE ENGINEERING PROCESS GROUP (SEPG) CONFERENCE

February 18-21, 2002 **Phoenix, Arizona**

Some 1,700 software and systems engineers and managers representing 25 countries attended the 14th annual SEPG[SM] conference.[46]

The conference offered presentations, tutorials, and keynote addresses on software process improvement, particularly incorporating the Capability Maturity Model® (CMM®) and the CMM Integration[SM] (CMMI®) models into organizations' projects and departments, and success stories from organizations using the Personal Software Process[SM] (PSP[SM]) and the Team Software Process[SM] (TSP[SM]).

The keynote speakers were Watts Humphrey from the SEI, Barry Boehm of the University of Southern California Center for Software Engineering, Stan Rifkin of Master Systems, Inc., and Michael Mah, editor of Information Technology Metrics Strategy and owner/partner of Quantitative Software Management Associates, Inc.

EUROPEAN SOFTWARE ENGINEERING PROCESS GROUP (E-SEPG) CONFERENCE

April 9-12, 2002 **Amsterdam, The Netherlands**

The seventh annual E-SEPG,[47] a joint initiative between the SEI and the European Software Process Improvement (ESPI) Foundation, brought together European software process improvement practitioners and industry leaders to discuss current best practices and industry results.

The conference provided a forum for practitioners to share experiences with their peers in Europe regarding productivity gains in software development through the adoption of software process improvement. It provided guidance, inspiration, and real-world experience reports demonstrating current thinking and proven techniques for improving quality, productivity, and predictability in software projects.

The next E-SEPG Conference will be held June 16-19, 2003, in London, England.

TIDE 2002

TECHNOLOGY INSERTION, DEMONSTRATION, AND EVALUATION (TIDE) CONFERENCE

September 24, 2002 **Mars, Pennsylvania**

Presentations and tutorials at the TIDE Conference,[40] attended by 132 people, focused on the goal of the TIDE Program: to encourage and assist small manufacturers in the adoption of commercially available software and other information technology solutions. The TIDE Program focuses on small manufacturers that supply goods and services that are important to the nation's defense.

John Foreman, director of the Dynamic Systems Program at the SEI, delivered a keynote presentation, "Helping Small Manufacturers Succeed in the DoD Supply Chain." Dan Cundiff, associate director for Manufacturing Technology & Affordability, Office of the Deputy Under Secretary of Defense (Advanced Systems & Concepts), delivered the second keynote presentation, "ManTech Manufacturing Technology Program."

The 2002 TIDE Conference was well received, with almost 85% of attendees saying that they would return to future TIDE conferences and would recommend the conference to colleagues.

LEADERSHIP AND OVERSIGHT

DIRECTOR'S OFFICE

Stephen E. Cross
Director and Chief Executive Officer

Clyde Chittister
Chief Operating Officer

SEI MANAGEMENT TEAM

William C. Peterson
Director, Software Engineering Process Management Program
Capability Maturity Model® Integration
Software Engineering Measurement and Analysis
Team Software Process℠

Brian Gallagher
Director, Acquisition Support Program

Linda M. Northrop
Director, Product Line Systems Program
Architecture Tradeoff Analysis
Predictable Assembly from Certifiable Components
Product Line Practice

Thomas C. Brandt
Director, Program Integration Directorate

Sally A. Cunningham
Director, Technology Transition Services Directorate

Peter Menniti
Manager, Financial and Business Services

Rochelle Koch
Manager, Human Resources

John Foreman
Director, Dynamic Systems Program
COTS-Based Systems
Performance-Critical Systems

Steven K. Huth
Manager, Information Technology

Maureen McFalls
Carnegie Mellon—Director, Government Relations

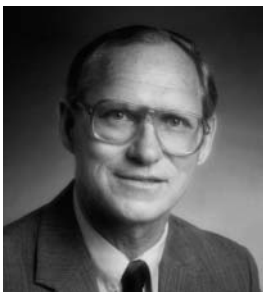
Richard D. Pethia
Director, Networked Systems Survivability Program
Survivable Systems

BOARD OF VISITORS

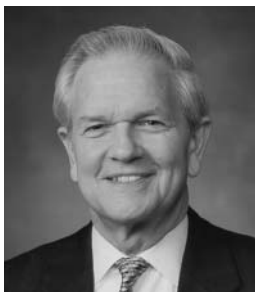
The SEI's Board of Visitors was established to advise the Carnegie Mellon University president and provost and the SEI director on the SEI's plans and operations.

The board monitors SEI activities, provides reports to the president and provost on the state of the SEI, and makes recommendations for improvement.

Dr. Roger R. Bate
Chief Architect, CMM Integration℠
Software Engineering Institute Fellow
Former Chief Computer Scientist, Texas Instruments

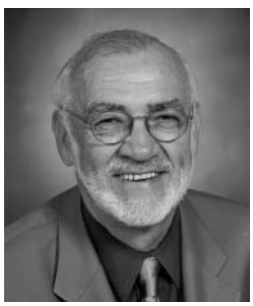


Dr. Barry W. Boehm
TRW Professor of Software Engineering, Computer Science Department Director, University of Southern California Center for Software Engineering



Mr. William C. Bowes
Vice President, Program Management, Litton Industries

Ms. Christine B. Davis
Chair, Board of Visitors
Independent Consultant
Former Executive Vice President, Raytheon Systems Company



Mr. Gilbert F. Decker
Private Consultant
Former Executive Vice President of Engineering and Production, Walt Disney Imagineering

Dr. Gerald P. Dinneen
Chair, Policy Division National Research Council

Mr. Philip L. Dowd
Senior Vice President, SunGard Data Systems
Trustee, Carnegie Mellon University

Mr. Dave McCurdy
President, Electronic Industries Alliance
Former Member, U.S. House of Representatives

Dr. Alan B. Salisbury
President, Learning Tree International

Mr. Donald E. Stitzenberg
Vice President, Global Supply Chain, Merial (a Merck division)
Trustee, Carnegie Mellon University

Mr. Dennis Yablonsky
President and Chief Executive Officer, Pittsburgh Digital Greenhouse

JOINT ADVISORY COUNCIL

The Joint Advisory Council functions as the SEI's board of directors. It provides strategic advice to the SEI's executive agent and primary sponsor. Such advice includes review of the SEI strategic plan and program plan.

Dr. Charles Holland, Chair
Deputy Under Secretary of Defense
(Science & Technology)

Dr. Nancy Spruill, Vice Chair
Director, Acquisition
Resources and Analysis

Office of the Under Secretary of Defense
(Acquisition, Technology, & Logistics)

Dr. Michael Andrews II
Deputy Assistant Secretary of the Army
(Research and Technology)

Represented by
Mr. Robert Saunders
Defense Advanced
Research Projects Agency

RADM Jay Cohen
Chief of Naval Research

Office of Naval Research

Represented by
Dr. Ralph F. Wachter
Office of Naval Research

Dr. James Linnehan
Office of the Assistant Secretary
of the Army (Acquisition, Logistics,
& Technology)

Mr. Blaise Durante
Deputy Assistant Secretary
of the Air Force for Acquisition
(Management Policy
and Program Integration)

Mr. John R. Landon
Deputy Assistant Secretary of Defense

Command, Control, Communications,
Computers, Intelligence, and Surveillance
& Reconnaissance and Space

Dr. Glenn Lamartin
Director, Strategic & Tactical Systems

Office of the Under Secretary of Defense
(Acquisition, Technology, & Logistics)

Represented by
Dr. Spiros Pallas
Principal Deputy to the Director,
Strategic & Tactical Systems

Office of the Under Secretary of Defense
(Acquisition, Technology, & Logistics)

Ms. Kathy MacDonald
Deputy Director

Defense Advanced Research Projects Agency

Dr. Margaret Myers
Principal Director

Deputy Assistant Secretary of Defense
(Deputy Chief Information Officer)

Represented by
Dr. Raymond Paul
Organization of the Deputy Assistant Secretary
of Defense for Spectrum, Space, Sensors
& Command, Control, and Communications

Mr. Michael O'Driscoll
Deputy Chief Engineer

Office of Assistant Secretary of the Navy
(Research, Development, and Acquisition)

Ms. Sue Payton
Deputy Under Secretary of Defense
(Advanced Systems and Concepts)

Mr. Henk Ruck
Deputy Assistant Secretary of the Air Force
(Science, Technology, & Engineering)

Air Force Research Laboratory

Dr. Starnes Walker
Deputy Director

Defense Threat Reduction Agency

Represented by
Dr. Mike McGreer

Mr. Robert M. Wright
Chief, Information Management

Missile Defense Agency

SEI STAFF INFORMATION AND TRANSITION ACTIVITIES

TECHNICAL LEADERSHIP POSITIONS

Barbacci, M. ▪ member, Accreditation Board for Engineering and Technology (ABET) ▪ representative, Institute of Electrical and Electronics Engineers (IEEE) Region 9 Congress annual planning meeting, Miami, FL, March 4-8, 2002 ▪ steering committee member, IEEE Information Survivability Workshops ▪ judge, IEEE Computer Society International Design Competition ▪ lecturer, IEEE Computer Society Distinguished Visitor Program

Barbour, R. ▪ director of administration, Risk Special Interest Group, Program Management Institute

Bass, L. ▪ editorial board member, *Universal Access in the Information Society: An International Interdisciplinary Journal*, Springer ▪ member, Visiting Committee for Information Science and Technology, NASA Goddard Space Flight Center ▪ Association for Computing Machinery (ACM) representative, International Federation for Information Processing (IFIP) Technical Committee on Software: Theory and Practice ▪ program committee member, International Conference on Software Reuse, Austin, TX, April 15-19, 2002 ▪ program committee member, Working IEEE/IFIP Conference on Software Architectures (WICSA) 2002, Montreal, Canada, Aug. 25-31, 2002 ▪ program co-chair, Second Software Product Line Conference (SPLC2), San Diego, CA, Aug. 19-22, 2002 ▪ program committee member, Third Working Conference on Software Architecture, Montreal, Canada, Aug. 25-31, 2002

Blanchette, Jr., S. ▪ member, Annual Fund Leadership and Advisory Committee, Embry-Riddle Aeronautical University ▪ article referee, *IEEE Software* ▪ article referee, *Computer*, IEEE

Brownsword, L. ▪ chair, International Conference on COTS-Based Software Systems (ICCBSS), Feb. 7-9, 2002, Orlando, FL

Buhman, C. ▪ member, Advanced Manufacturing Enterprise subpanel, Joint Defense Manufacturing Technology Panel

Carter, L. ▪ commissioner, Computing Accreditation Commission, ABET

Chittister, C. ▪ member, Capability Maturity Model Integration (CMMI) Steering Group

Cohen, S. ▪ reviewer and panelist, Young Researcher's Workshop, and member, program committee, International Conference on Software Reuse, Austin, TX, April 15-19, 2002

Cross, S. ▪ member, Air Force Scientific Advisory Board ▪ member, Air Force Acquisition Work Force Culture Transformation Board ▪ chair emeritus and member of the Executive Committee, Defense Advanced Research Projects Agency (DARPA) Information Science and Technology (ISAT) panel ▪ member, Naval Post Graduate School Software Engineering Advisory Board ▪ deputy director, Internet Security Alliance, Electronic Industries Alliance (EIA) ▪ Distinguished Alumnus Award, School of Engineering, University of Cincinnati

Dailey, T. ▪ member, National Defense Industrial Association (NDIA) Science and Engineering Technology (S&ET) Advisory Board

Feiler, P. ▪ secretary, co-author, and editor, Avionics Architecture Description Language Standard (AADL/SAE-AS2C), subcommittee, Society of Automotive Engineers (SAE)

Forrester, E. ▪ program committee member, IFIP 8.6 Working Conference: The Adoption and Diffusion of IT in an Environment of Critical Change, Aug. 1-3, 2002, Sydney, Australia

Gallagher, B. ▪ technical co-chair, First Annual CMMI User's Group Conference, Arlington, VA, Nov. 13-15, 2001

Goldenson, D. ▪ software inspections chair, Eighth IEEE Symposium on Software Metrics, Ottawa, Canada, June 4-7, 2002

Hissam, S. ▪ organizing committee member, Meeting Challenges and Surviving Success: Second Workshop on Open Source Software Engineering, part of the 24th International Conference on Software Engineering (ICSE 2002), Orlando, FL, May 19-25, 2002 ▪ program committee member, International Workshop on Requirements for High Assurance Systems, Essen, Germany, Sept. 9, 2002 ▪ executive committee member, advisory board, Computer Science and Electrical Engineering Department, West Virginia University

Humphrey, W. ▪ editorial board member, *Journal of Empirical Software Engineering*, Kluwer Academic Publishers ▪ editorial board member, *Software Process Improvement and Practice*, John Wiley & Sons, Ltd. ▪ guest editor, *IEEE Software: Special Issue on Educating Software Professionals 19*, 5 (September/October 2002)

Jarrad, S. ▪ guest editor, *IEEE Software 19*, 4 (July/August 2002)

Jones, L. ▪ criteria committee chair and invited panelist, Conference on Information Technology Curriculum, Aspen Grove, UT, December 2001 ▪ evaluator, Software Engineering Program, ABET

Konrad, M. ▪ invited member, Steering Committee for the IEEE Software Engineering Standards Committee (SESC)

King, B. ▪ secretary, InfraGard Executive Board

Klein, M. ▪ workshop chair, Third Working Conference on Software Architecture, Montreal, Canada, Aug. 25-31, 2002

Laswell, B. ▪ chair, Training and Education Working Group, National Cybercrime and Cyberterrorism Summit, Princeton, NJ, April 22-25, 2002 ▪ member, U.S. Delegation to Indo-U.S. Plenary Meeting on Cyberterrorism and Critical Infrastructure Protection, New Delhi, India, April 29-30, 2002

Levine, L. ▪ program committee member, IFIP 8.6 Working Conference: The Adoption and Diffusion of IT in an Environment of Critical Change, Aug. 1-3, 2002, Sydney, Australia ▪ vice chair, IFIP Working Group 8.6, Transfer and Diffusion of Information Technology

Lewis, G. ▪ Alumni Advisory Board member, School of Computer Science, Carnegie Mellon University ▪ Master of Software Engineering executive committee member, Carnegie Mellon University

Lipson, H. ▪ panel co-chair, (ICCBSS) Orlando, FL, Feb. 4-6, 2002 ▪ steering committee member, IEEE Information Survivability Workshops ▪ chairman, advisory board, Duquesne University Computational Mathematics Master's Degree Program

Little, R. ▪ vice chair, High-Level Architecture (HLA) Federation Development and Execution Process Working Group, IEEE Computer Society Simulation Interoperability Standards Committee ▪ program committee member, Simulation Interoperability Conference, Orlando, FL, May 2002 ▪ program committee member, European Simulation Interoperability Conference, Stockholm, Sweden, June 2002

Longstaff, T. ▪ steering committee member, IEEE Information Survivability Workshops ▪ program committee member, International Conference on Dependable Systems and Networks

Marz, T. ▪ chair, Fault Tolerance Subgroup, Common Operating Environment (COE) Real-Time Advisory Group

McGregor, J. ▪ guest editor, *IEEE Software 19*, 4 (July/August 2002)

McHugh, J. ▪ chair, Fourth IEEE Information Survivability Workshop, Vancouver, Canada, March 18-20, 2002

Mead, N. ▪ editorial board member, *Annals of Software Engineering*, Kluwer Academic Publishers ▪ industry advisory board member, *IEEE Software* ▪ member, Working Group on Software Engineering Education & Training ▪ panel co-chair, ICCBSS, Orlando, FL, Feb. 4-6, 2002 ▪ program committee member, 14th International Conference on Advanced Information Systems Engineering (CAiSE02), Toronto, Canada, May 27-31, 2002 ▪ steering committee chair, IEEE Joint International Requirements Engineering Conference, Sept. 9-13, 2002 ▪ steering committee member, 15th Conference on Software Engineering Education & Training, Feb. 25-27, 2002 ▪ workshop co-chair, International Requirements Engineering Conference, Essen, Germany, Sept. 9-13, 2002

Meyers, C. ▪ member, Portable Operating System Interface (POSIX) Working Group IEEE 1003.21: Real-Time Distributed Systems Communications, Language Independent Specification

Nord, R. ▪ program committee member, ICSE 2002

Northrop, L. ▪ guest editor, *IEEE Software 19*, 4 (July/August 2002) ▪ program committee member, Ground System Architecture Workshop (GSAW), El Segundo, CA, March 13-15, 2002 ▪

steering committee chair, ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA) ▪ executive committee member, ACM Special Interest Group for Programming Languages (SIGPLAN) ▪ selection committee member, Carnegie Science Center Awards for Excellence ▪ program committee member, European Conference on Object-Oriented Programming (ECOOP), University of Málaga, Spain, June 10-14, 2002 ▪ conference chair, SPLC2, San Diego, CA, Aug. 19-22, 2002 ▪ conference chair, OOPSLA, Tampa, FL, Oct. 14-18, 2001 ▪ co-chair, Fourth International Workshop on Software Product Family Engineering, Bilbao, Spain, Oct. 3-5, 2001

O'Brien, L. ▪ program committee member, Software Technology and Engineering Practice (STEP) Conference, Montreal, Canada, Oct. 6-8, 2001 ▪ workshop co-chair, Mining and Reengineering of Legacy Assets for Use in a New System or Product Line, WICSA, Montreal, Canada, Aug. 25-31, 2002

Palmquist, S. ▪ secretary, Information and Command and Control Technical Committee, American Institute of Aeronautics and Astronautics (AIAA)

Peterson, W. ▪ member, Capability Maturity Model Integration (CMMI) Steering Group

Pohl, K. ▪ guest editor, *IEEE Software 19*, 4 (July/August 2002)

Shupack, M. ▪ member, Office of the Secretary of Defense (OSD) Computer Network Defense Research and Technology Workshop, Aug. 20-22, 2002

Siviy, J. ▪ measurement working group member, International Council on Systems Engineering (INCOSE) ▪ secretary, American Society for Quality (ASQ), Pittsburgh Section

Smith, D. ▪ external evaluator, Natural Sciences and Engineering Research Council (NSERC), Canada ▪ steering committee chair, International Workshop on Computer-Aided Software Engineering (IWCASE)

Stafford, J. ▪ program committee member, Fourth Australian Workshop on Software and System Architectures, Sydney, Australia, Feb. 17-18, 2002 ▪ reviewer, research grant proposals for component-based software, Science Foundation Ireland ▪ co-organizer, Workshop on Component-Based Software Engineering: Composing Systems from Components, Ninth IEEE Conference and Workshops on Engineering Component-Based Systems, Lund, Sweden, April 10-11, 2002 ▪ co-organizer, Fifth ICSE Workshop on Component-Based Software Engineering, ICSE 2002

Waclo, J. ▪ committee member, IEEE Nuclear Power Engineering ▪ subcommittee 6 member, IEEE Nuclear Power Engineering ▪ working group 6.4 member, IEEE Nuclear Power Engineering

Wallnau, K. ▪ tutorial chair, ICSE, Orlando, FL, May 19-25, 2002 ▪ co-organizer, Fifth ICSE Workshop on Component-Based Software Engineering, Orlando, FL, May 19-20, 2002 ▪ program committee member, First International IFIP/ACM Working Conference on Component Deployment (CD 2002), Berlin, Germany, June 20-21, 2002

Weinstock, C. ▪ editor, *FT News*, newsletter of the IEEE Computer Society Technical Committee on Fault Tolerant Computing ▪ steering committee member, International Conference on Dependable Systems and Networks, Washington, DC, June 23-26, 2002 ▪ local arrangements co-chair, International Conference on Dependable Systems and Networks, Bethesda, MD, June 23-26, 2002 ▪ steering committee member, IEEE Computer Society Technical Committee on Fault Tolerant Computing

Zubrow, D. ▪ editorial board member, *Software Quality Professional*, ASQ ▪ associate editor, *Software Quality*, newsletter of the software division of ASQ ▪ reviewer, *IEEE Transactions on Software Engineering* ▪ member, technical advisory group for software engineering, International Organization for Standardization (ISO) ▪ program committee member, Workshop on Software and Performance, Rome, Italy, July 24-26, 2002 ▪ member, Department of Defense Measurement Initiative ▪ technical steering committee member, Practical Software and Systems Project, OSD, Software Intensive Systems ▪ chair, International Conference on Software Quality, Pittsburgh, PA, Oct. 23-24, 2001

TECHNICAL STAFF DEMOGRAPHICS

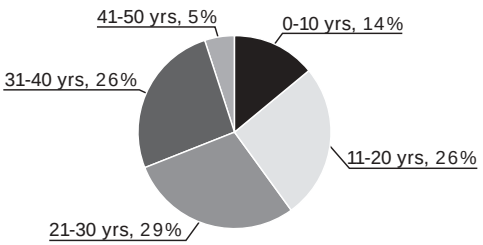
SEI staff members include technical staff, support staff, resident affiliates, and visiting scientists. Resident affiliates are personnel from industry or government who come to the SEI as members of the technical staff, at their organizations' expense, to work at the SEI for one to two years. Visiting scientists are temporary employees from industry, academia, or government. The following are SEI employment figures as of Sept. 30, 2002:

- 308 technical staff, including 73 visiting scientists
- 124 support staff
- 17 resident affiliates

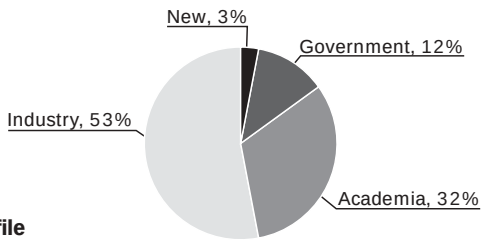
SEI Affiliate Program

Through the Affiliate Program, sponsoring organizations contribute their best ideas and people to the SEI's ongoing effort to define superior software engineering practices. During the term of collaboration, affiliates lend their technical knowledge and experience to SEI teams investigating specific technology domains. As team members on SEI projects, affiliates collaborate with SEI staff to identify, develop, and demonstrate improved practices. The SEI has had a total of 176 affiliates to date. Affiliates' sponsoring organizations represent industry (76%), government (15%), and academia (9%).

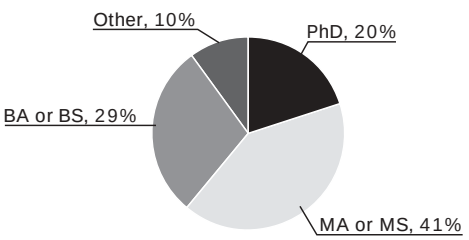
Years of Experience



Previous Affiliation



Education Profile



SEI COURSES

SEI courses[6] help bring state-of-the-art technologies and practices from the research lab into widespread use. The following courses were taught during FY2002 at the SEI's facilities in Pittsburgh, PA, and Arlington, VA, and at sites in Dallas, TX; Seattle, WA; Salt Lake City, UT; Las Vegas, NV; Orlando, FL; Montreal, Canada; London, England; Frankfurt, Germany; Amsterdam, The Netherlands; and Thales University, France. The number of offerings is indicated in parentheses.

Organizational Management Development

Consulting Skills Workshop (1)

Capability Maturity Model® Integration (CMMI®)

Intermediate Concepts of Capability Maturity Model Integration (14)

Introduction to Capability Maturity Model-Integrated—Systems Engineering and Software Engineering, V1.0, Continuous Representation (8)

Introduction to Capability Maturity Model-Integrated—Systems Engineering and Software Engineering, V1.0, Staged Representation (9)

Standard CMMI Assessment Method for Process Improvement (SCAMPI℠) Lead Appraiser℠ Training (5)

Instructor Training for CMMI (8)

Capability Maturity Models

Introduction to the Capability Maturity Model for Software (11)

Introduction to the People Capability Maturity Model (4)

Introduction to the Software Acquisition Capability Maturity Model (4)

COTS-Based Systems

COTS-Based Systems for Program Managers (2)

Software Process Improvement

Capability Maturity Model-Based Appraisal Lead Assessor Training (4)

Continuous Risk Management (2)

Defining Software Processes (1)

High Maturity with Statistics (4)

Implementing Goal-Driven Software Measurement (1)

Introduction to Personal Software Process℠ (PSP℠) (2)

Managing Team Software Process℠ (TSP℠) Teams (1)

Managing Software Projects with Metrics (2)

Mastering Process Improvement (3)

Personal Software Process for Engineers I: Planning (2)

Personal Software Process for Engineers II: Quality (2)

Personal Software Process Instructor Training (2)

Software Capability Evaluation Lead Evaluator Training (2)

Statistical Process Control for Software (1)

Team Software Process Launch Coach Training (2)

Team Software Process Executive Seminar (1)

Computer and Network Security

Advanced Incident Handling for Technical Staff (3)

Fundamentals of Incident Handling (2)

Concepts and Trends in Information Security (4)

Information Security for Technical Staff (4)

Managing Computer Security Incident Response Teams (3)

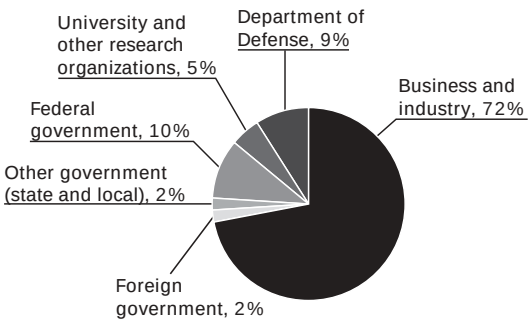
Overview of Managing Computer Security Incident Response Teams (4)

Creating a Computer Security Incident Response Team (4)

Operationally Critical Threat, Asset, and Vulnerability Evaluation℠ (OCTAVE℠) Method Training Workshop (3)

Information Survivability: A New Executive Perspective (9)

Course Attendees by Category of Organization (1839 total attendees)



SEI-PUBLISHED DOCUMENTS

Documents published by the SEI include the following types:

- *Technical reports* (TRs) contribute to a specific body of knowledge by offering new technical information about a software topic, whether theoretical or applied.
- *Technical notes* (TNs) make publicly available peer-to-peer information about a software engineering topic, quickly, and in an abbreviated format.
- *Special reports* (SRs) provide information to a limited audience about software-related work, or provide non-technical information about software-related work to a general audience.
- *Security improvement modules* (SIMs) present a set of recommended practices that, if adopted, can help an organization improve its networked systems security in a specific problem domain.
- *Handbooks* (HBs) instruct a reader on how and when to use a process, method, or technology.

Albert, C.; Brownsword, L. ▪ *Evolutionary Process for Integrating COTS-Based Systems (EPIC): An Overview* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr009.html

Alberts, C.; Dorofee, A. ▪ *OCTAVE℠ Criteria, Version 2.0* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr016.html

Alberts, C.; Dorofee, A.; Allen, J. ▪ *OCTAVE℠ Catalog of Practices, Version 2.0* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr020.html

Anderson, W.; Bergey, J.; Fisher, M.; Graettinger, C.; Hansen, W.; Obenza, R.; Smith, D.; Stevens, H. ▪ *Army Workshop on Lessons Learned from Software Upgrade Programs* (SR), http://www.sei.cmu.edu/publications/documents/01.reports/01sr021.html

Asundi, J.; Kazman, R.; Klein, M. ▪ *Using Economic Considerations to Choose Among Architecture Design Alternatives* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr035.html

Bachmann, F.; Bass, L.; Clements, P.; Garlan, D.; Ivers, J.; Little, R.; Nord, R.; Stafford, J. ▪ *Documenting Software Architecture: Documenting Behavior* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn001.html

Bachmann, F.; Bass, L.; Clements, P.; Garlan, D.; Ivers, J.; Little, R.; Nord, R.; Stafford, J. ▪ *Documenting Software Architectures: Organization of Documentation Package* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn010.html

Barbacci, M.; Ellison, R.; Lattanze, A.; Stafford, J.; Weinstock, C.; Wood, W. ▪ *Quality Attribute Workshops, Second Edition* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr019.html

Barbour, R.; Benhoff, M.; Gallagher, B.; Eslinger, S.; Bernard, T.; Ming, L.; Rosa, L.; Ryan, C. ▪ *Standard CMMI® Appraisal Method for Process Improvement (SCAMPI℠), Version 1.1: Method Implementation Guidance for Government Source Selection and Contract Process Monitoring* (HB), http://www.sei.cmu.edu/publications/documents/02.reports/02hb002.html

Barbour, R.; Bernard, T. ▪ *SCAMPI℠ V1.1 Use in Supplier Selection and Contract Process Monitoring* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn008.html

Bass, L.; Buhman, C.; Comella-Dorda, S.; Long, F.; Robert, J.; Seacord, R.; Wallnau, K. ▪ *Volume II: Technical Concepts of Component-Based Software Engineering, Second Edition* (TR), http://www.sei.cmu.edu/publications/documents/00.reports/00tr008.html

Bass, L.; Klein, M.; Moreno, G. ▪ *Applicability of General Scenarios to the Architecture Tradeoff Analysis Method℠* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr014.html

Bergey, J.; Cohen, S.; Fisher, M.; Campbell, G.; Jones, L.; Krut, R.; Northrop, L.; O'Brien, W.; Smith, D.; Soule, A. ▪ *Fourth DoD Product Line Practice Workshop Report* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr017.html

Bergey, J.; Fisher, M.; Jones, L. ▪ *Use of the Architecture Tradeoff Analysis Method℠ (ATAM℠) in Source Selection of Software-Intensive Systems* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn010.html

Bergey, J.; Fisher, M. ▪ *Use of the ATAM℠ in the Acquisition of Software-Intensive Systems* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn009.html

Bergey, J.; Wood, W. ▪ *Use of Quality Attribute Workshops (QAWs) in Source Selection for a DoD System Acquisition: A Case Study* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn013.html

CMMI Product Team ▪ *CMMI® for Systems Engineering/Software Engineering, Version 1.1, Continuous Representation (CMMI-SE/SW, V1.1, Continuous)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr001.html

CMMI Product Team ▪ *CMMI® for Systems Engineering/Software Engineering, Version 1.1, Staged Representation (CMMI-SE/SW, V1.1, Staged)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr002.html

CMMI Product Team ▪ *CMMI® for Systems Engineering/Software Engineering/Integrated Product and Process Development, Version 1.1, Continuous Representation (CMMI-SE/SW/IPPD, V1.1, Continuous)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr003.html

CMMI Product Team ▪ *CMMI® for Systems Engineering/Software Engineering/Integrated Product and Process Development, Version 1.1, Staged Representation (CMMI-SE/SW/IPPD, V1.1, Staged)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr004.html

CMMI Product Team ▪ *Appraisal Requirements for CMMI®, Version 1.1 (ARC, V1.1)* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr034.html

CMMI Product Team ▪ *CMMI® for Software Engineering, Version 1.1, Continuous Representation (CMMI-SW, V1.1, Continuous)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr028.html

CMMI Product Team ▪ *CMMI® for Software Engineering, Version 1.1, Staged Representation (CMMI-SW, V1.1, Staged)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr029.html

CMMI Product Team ▪ *CMMI® for Systems Engineering/Software Engineering/Integrated Product and Process Development/Supplier Sourcing, Version 1.1, Continuous Representation (CMMI-SE/SW/IPPD/SS, V1.1, Continuous)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr011.html

CMMI Product Team ▪ *CMMI® for Systems Engineering/Software Engineering/Integrated Product and Process Development/Supplier Sourcing, Version 1.1, Staged Representation (CMMI-SE/SW/IPPD/SS, V1.1, Staged)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr012.html

Campbell, G. ▪ *A Software Product Line Vision for Defense Acquisition* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn002.html

Bachmann, F.; Bass, L.; Clements, P.; Garlan, D.; Ivers, J.; Little, R.; Nord, R.; Stafford, J. ▪ *Documenting Software Architecture: Documenting Interfaces* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn015.html

Carter, L.; Graettinger, C.; Patrick, M.; Wemyss, G.; Zasadni, S. ▪ *The Road to CMMI®: Results of the First Technology Transition Workshop* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr007.html

Chastek, G.; McGregor, J. ▪ *Guidelines for Developing a Product Line Production Plan* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr006.html

Clements, P.; Cohen, S.; Donohoe, P.; Northrop, L. ▪ *Control Channel Toolkit: A Software Product Line Case Study* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr030.html

Clements, P.; Donohoe, P.; Kang, K.; McGregor, J.; Northrop, L. ▪ *Fifth Product Line Practice Workshop Report* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr027.html

Comella-Dorda, S.; Gluch, D.; Hudak, J.; Lewis, G.; Weinstock, C. ▪ *Model-Based Verification: Claim Creation Guidelines* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn018.html

Cooper, J.; Fisher, M. ▪ *Software Acquisition Capability Maturity Model® (SA-CMM®) Version 1.03* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr010.html

Davis, N.; McHale, J. ▪ *Relating the Team Software Process℠ (TSP℠) to the Capability Maturity Model® for Software (SW-CMM®)* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr008.html

Dunaway, D.; Baker, M. ▪ *Analysis of CMM®-Based Appraisal for Internal Process Improvement (CBA IPI) Assessment Feedback* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr021.html

Dunaway, D.; Masters, S. ▪ *CMM®-Based Appraisal for Internal Process Improvement (CBA IPI) Version 1.2 Method Description* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr033.html

Eguiluz, H.; Govi, V.; Kim, Y.; Sia, A. ▪ *PAMD: Developing a Plug-In Architecture for Palm OS-Powered Devices Using Software Engineering* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn020.html

Ellis, H.; Moreno, A.; Mead, N.; Seidman, S. ▪ *Reeducation to Expand the Software Engineering Workforce: Successful Industry/University Collaborations* (SR), http://www.sei.cmu.edu/publications/documents/02.reports/02sr001.html

Ellison, R.; Moore, A. ▪ *Architectural Refinement for the Design of Survivable Systems* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn008.html

Gallagher, B. ▪ *Interpreting Capability Maturity Model® Integration (CMMI®) for Operational Organizations* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn006.html

Gluch, D.; Comella-Dorda, S.; Hudak, J.; Lewis, G.; Walker, J.; Weinstock, C. ▪ *Model-Based Verification—Scope, Formalism, and Perspective Guidelines* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn024.html

Gluch, D.; Comella-Dorda, S.; Hudak, J.; Lewis, G.; Weinstock, C. ▪ *Model-Based Verification: Guidelines for Generating Expected Properties* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn003.html

Gluch, D.; Hudak, J.; Janousek, R.; Walker, J.; Weinstock, C.; Zubrow, D. ▪ *Framework Document: Model-Based Verification Pilot Study* (SR), http://www.sei.cmu.edu/publications/documents/01.reports/01sr024.html

Goethert, W.; Hayes, W. ▪ *Experiences in Implementing Measurement Programs* (TN), http:// www.sei.cmu.edu/publications/documents/01.reports/01tn026.html

Hissam, S.; Moreno, G.; Stafford, J.; Wallnau, K. ▪ *Packaging Predictable Assembly with Prediction-Enabled Component Technology* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr024.html

Hissam, S.; Weinstock, C.; Plakosh, D.; Asundi, J. ▪ *Perspectives on Open Source Software* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr019.html

Jones, L.; Lattanze, A. ▪ *Using the Architecture Tradeoff Analysis Method℠ to Evaluate a Wargame Simulation System: A Case Study* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn022.html

Jones, L.; Soule, A. ▪ *Software Process Improvement and Product Line Practice: CMMI® and the Framework for Software Product Line Practice℠* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn012.html

Keshavamurthy, M.; Kim, J.; Li, M.; Sagetong, V. ▪ *Plug-In Architecture for Mobile Devices* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn023.html

Levine, L.; Baskerville, R.; Link, J.; Pries-Heje, J.; Ramesh, B.; Slaughter, S. ▪ *Discovery Colloquium: Quality Software Development @ Internet Speed* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr020.html

Lewis, G.; Comella-Dorda, S.; Gluch, D.; Hudak, J.; Weinstock, C. ▪ *Model-Based Verification: Analysis Guidelines* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn028.html

Lewis, G.; Comella-Dorda, S.; Place, P.; Plakosh, D.; Seacord, R. ▪ *An Enterprise Information System Data Architecture Guide* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr018.html

Linger, R.; Moore, A. ▪ *Foundations for Survivable System Development: Service Traces, Intrusion Traces, and Evaluation Models* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr029.html

Lipson, H.; Mead, N.; Moore, A. ▪ *Can We Ever Build Survivable Systems from COTS Components?* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn030.html

Liu, A.; Bass, L.; Klein, M. ▪ *Analyzing Enterprise JavaBeans Systems Using Quality Attribute Design Primitives* (TN), http://www.sei.cmu.edu/publications/documents/01.reports/01tn025.html

McGregor, J. ▪ *Testing a Software Product Line* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr022.html

Members of the Assessment Method Integrated Team ▪ *Standard CMMI® Appraisal Method for Process Improvement (SCAMPI℠) Version 1.1: Method Definition Document* (HB), http://www.sei.cmu.edu/publications/documents/01.reports/01hb001.html

Meyers, B.; Oberndorf, P. ▪ *A Framework for the Specification of Acquisition Models* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr004.html

O'Brien, L.; Smith, D. ▪ *MAP and OAR Methods: Techniques for Developing Core Assets for Software Product Lines from Existing Assets* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn007.html

Paulk, M.; Chrissis, M. ▪ *The 2001 High Maturity Workshop,* (SR), http://www.sei.cmu.edu/publications/documents/01.reports/01sr014.html

Seacord, R.; Comella-Dorda, S.; Lewis, G.; Place, P.; Plakosh, D. ▪ *Legacy System Modernization Strategies* (TR), http://www.sei.cmu.edu/publications/documents/01.reports/01tr025.html

Seacord, R.; Wrage, L. ▪ *Replaceable Components and the Service Provider Interface* (TN), http://www.sei.cmu.edu/publications/documents/02.reports/02tn009.html

Software Engineering Institute ▪ *2001 Annual Report*, http://www.sei.cmu.edu/publications/documents/01.reports/01ar.html

Staley, M.; Oberndorf, P.; Sledge, C. ▪ *Using EVMS with COTS-Based Systems* (TR), http://www.sei.cmu.edu/publications/documents/02.reports/02tr022.html

In an article written by R.L. Glass and T.Y. Chen for the *Journal of Systems and Software 64*, 3 (2002), the authors report that Carnegie Mellon/SEI is the number one institution for publishing scholarly articles in the field of systems and software engineering. This is the fifth consecutive year that Carnegie Mellon has achieved this rating, largely on the strength of the SEI's publishing activities. The article is the ninth in an annual series in the journal. It includes five years of data and is based on frequency of publication in the following journals:

- *Information and Software Technology*
- *Journal of Systems and Software*
- *Software Practice and Experience*
- *IEEE Software*
- *Transactions on Software Engineering and Methodologies* (ACM)
- *Transactions on Software Engineering* (IEEE)

BOOK CHAPTERS

Cross, S. ▪ "Reflections on the Process Revolution." *Software Management,* Sixth Edition, Reifer, D. (Ed.). Los Alamitos, CA: IEEE Computer Society, 2002, 77-90

Goldenson, D. ▪ "Measurement and Analysis in Software Process Improvement." *IT Measurement: Practical Advice from the Experts*. International Function Point Users Group (Ed.). Boston, MA: Addison-Wesley, 2002, 577-604

Paulk, M. ▪ "Extreme Programming from a CMM Perspective." Succi, G. (Ed.). *Extreme Programming Perspectives*. Boston, MA: Addison-Wesley, 2002, 483-501

Stafford, J.; Bosch, J. ▪ "Architecting Component-Based Systems." *Building Reliable Component-Based Software Systems*. Crnkovic, I. and Marsson, M. (Eds.). Boston, MA: Artech House, 2002, 41-56

Stafford, J.; Wallnau, K. ▪ "Component Composition and Integration." *Building Reliable Component-Based Software Systems*. Crnkovic, I. and Marsson, M. (Eds.). Boston, MA: Artech House Publishers, 2002, 179-192

Wallnau, K.; Stafford, J. ▪ "Dispelling the Myth of Component Evaluation." *Building Reliable Component-Based Software Systems*. Crnkovic, I. and Marsson, M. (Eds.). Boston, MA: Artech House, 2002, 157-178

BOOKS

Ahern, D.; Clouse, A.; Turner, R. ▪ *CMMI® Distilled: A Practical Introduction to Integrated Process Improvement.* Boston, MA: Addison-Wesley, 2001

Alberts, C.; Dorofee, A. ▪ *Managing Information Security Risks: The OCTAVE℠ Approach*. Boston, MA: Addison-Wesley, 2002

Clements, P.; Bachmann, F.; Bass, L.; Garlan, D.; Ivers, J.; Little, R.; Nord, R.; Stafford, J. ▪ *Documenting Software Architectures: Views and Beyond*. Boston, MA: Addison-Wesley, 2002

Curtis, B.; Hefley, W.; Miller, S. ▪ *People Capability Maturity Model®: Guidelines for Improving the Workforce*. Boston, MA: Addison-Wesley, 2002

Humphrey, W. ▪ *Winning with Software: An Executive Strategy*. Boston, MA: Addison-Wesley, 2002

Larsson, M.; Crnkovic, I. (Eds.) ▪ *Building Reliable Component-Based Software Systems*. Boston, MA: Artech House, 2002

Paulish, D. ▪ *Architecture-Centric Software Project Management: A Practical Guide.* Boston, MA: Addison-Wesley, 2002

PUBLISHED PROCEEDINGS

Albert, C.; Brownsword, L. ▪ "Meeting the Challenges of Commercial Off-the-Shelf (COTS) Products: The Information Technology Solutions Evolution Process (ITSEP)," 10-20, *Lecture Notes in Computer Science 2255: First International Conference on COTS-Based Software Systems (ICCBSS) 2002,* Orlando, FL, February 4-6, 2002

Baskerville, R.; Levine, L.; Pries-Heje, J.; Ramesh, B.; Slaughter, S. ▪ "Divergent Practices for Speed and Agility in Internet Software Development," *International Conference on Information Systems: An IT Vision for the 21st Century*, New Orleans, LA, December 17-20, 2001

Bass, L.; Klein, M.; Bachmann, F. ▪ "Quality Attribute Design Primitives and the Attribute Driven Design Method," 169-186, *Lecture Notes in Computer Science 2290: Fourth International Workshop on Software Product Family Engineering*, Bilbao, Spain, October 3-5, 2001

Böckle, G.; Bermejo Muñoz, J.; Knauber, P. Krueger, C.; Leite, J.; Northrop, L.; Stark, M.; van der Linden, F.; Weiss, D. ▪ "Adopting and Institutionalizing a Product Line Culture," 49-59, *Lecture Notes in Computer Science 2379: Proceedings of the Second Software Product Line Conference*, San Diego, CA, August 19-22, 2002

Bunting, R.; Lewis, G.; Long, F.; Plakosh, D.; Seacord, R.; Wrage, L. ▪ "Knowledge Management in Component-Based Software Engineering," 91-95, *Proceedings of the International Conference on Information and Knowledge Engineering*, Las Vegas, NV, June 24-27, 2002

Clements, P. ▪ "On the Importance of Product Line Scope," 70-78, *Lecture Notes in Computer Science 2290: Fourth International Workshop on Software Product Family Engineering,* Bilbao, Spain, October 3-5, 2001

SEI authors had 14 articles published in the new *Encyclopedia of Software Engineering* (New York: John Wiley, 2002). The encyclopedia is a two-volume reference for those who design, write, or test computer programs.

The following articles appear in Volume 1:

- "Capability Maturity Model for Software," Mark Paulk
- "CERT Coordination Center," Linda Pesante
- "Cleanroom Software Engineering: Developing Software Under Statistical Quality Control," Richard C. Linger
- "Evaluation, Security," Christopher J. Alberts
- "Human Factors in Software Development," Bill Curtis
- "Object-Oriented Development," Linda M. Northrop

The following articles appear in Volume 2:

- "People CMM," Bill Curtis, William E. Hefley, and Sally A. Miller
- "Personal Software Process (PSP)," Watts S. Humphrey
- "Rate-Monotonic Analysis," Lui Sha and Ragunathan Rajkumar
- "Software Acquisition Capability Maturity Model (SA-CMM)," Jack R. Ferguson
- "Software Engineering Institute," Stephen E. Cross
- "Software Technology Transfer, Diffusion, Adoption, and Implementation," Priscilla Fowler
- "Statistical Process Control for Software," Anita D. Carleton and William A. Florac
- "Team Software Process (TSP)," Watts S. Humphrey

Comella-Dorda, S.; Dean, J.; Morris, E.; Oberndorf, P. ▪ "A Process for COTS Software Product Evaluation," 86-96, *Lecture Notes in Computer Science 2255: First International Conference on COTS-Based Software Systems (ICCBSS) 2002, Orlando, FL,* February 4-6, 2002

Crnkovic, I.; Schmidt, H.; Stafford, J.; Wallnau, K. ▪ "Benchmarks for Predictable Assembly," *Proceedings of the 24th International Conference on Software Engineering (ICSE),* 655-656, Orlando, FL, May 19-25, 2002

Florac, W. ▪ "Analyzing Process Behavior," *Proceedings of the 2002 Software Measurement/Applications of Software Measurement Conference*, Anaheim, CA, February 12, 2002

Gluch, D. ▪ "The Practical Use of Model Checking in Software Development," 21-27, *Proceedings IEEE SoutheastCon 2002*, Columbia, SC, April 5-7, 2002

Hissam, S.; Moreno, G.; Stafford, J.; Wallnau, K. ▪ "Packaging and Deploying Predictable Assembly," 108-124, *Lecture Notes in Computer Science 2370: Proceedings of the IFIP/ACM Working Conference on Component Deployment 2002 (CD2002)*, June 20-21, 2002

Hissam, S.; Seacord, R.; Lewis, G. ▪ "Building Systems from Commercial Components," 679-680, *Proceedings of the 24th International Conference on Software Engineering (ICSE)*, Orlando, FL, May 19-25 2002

Kang, K.; Donohoe, P.; Koh, E.; Lee, J.; Lee, K.; Chastek, G. (Ed.) ▪ "Using a Marketing and Product Plan as a Key Driver for Product Line Asset Development," 366-382, *Lecture Notes in Computer Science 2379: Proceedings of the Second Software Product Line Conference*, San Diego, CA, Aug. 19-22, 2002

Kazman, R.; Asundi, J.; Ran, A. ▪ "Adaptable Architectures for Mobile Systems," *Proceedings of the International Conference on Software Engineering Research and Practice (SERP '02)*, Las Vegas, NV, June 24-27, 2002

Lipson, H.; Mead, N.; Moore, A. ▪ "Can We Ever Build Survivable Systems from COTS Components?" 216-229, *Proceedings of the 14th International Conference on Advanced Information Systems Engineering (CAiSE '02)*, Toronto, Canada, May 2002

Moreno, G.; Hissam, S.; Wallnau, K. ▪ "Statistical Models for Empirical Component Properties and Assembly-Level Property Predictions: Toward Standard Labeling," *Proceedings of the Fifth ICSE Workshop on Component-Based Software Engineering*, Orlando, FL, May 19-20, 2002

McHugh, J. ▪ "An Information Flow Tool for Gypsy: An Extended Abstract Revisited," 191-201, *Proceedings of the 17th Annual Computer Security Applications Conference (ACSAC)* 2001, New Orleans, LA, December 10-14, 2001

Oberndorf, P.; Smith, J. ▪ "To COTS or Not to COTS—That Is the Question," *Proceedings of the 14th Annual Software Technology Conference*, Salt Lake City, UT, April 29-May 2, 2002

Pries-Heje, J.; Levine, L.; Slaughter, S. ▪ "Engineering Software @ Internet Speed," *International Conference on Software Quality*, Pittsburgh, PA, October 22-24, 2001

Saewong, S.; Rajkumar, R.; Lehoczky, J.; Klein, M. ▪ "Analysis of Hierarchical Fixed-Priority Scheduling," 152-160, *Proceedings of the 14th Euromicro Conference on Real-Time Systems*, Vienna, Austria, June 19-21, 2002

Seacord, R. ▪ "Replaceable Components and the Service Provider Interface," 222-223, *Lecture Notes in Computer Science 2255: First International Conference on COTS-Based Software Systems (ICCBSS) 2002,* Orlando, FL, February 4-6, 2002

Shimeall, T.; Williams, P. ▪ "Models of Information Security Trend Analysis," 43-52, *Proceedings of SPIE 4708: Sensors and Command, Control, Communications, and Intelligence (C3I) Technologies for Homeland Defense and Law Enforcement,* August 2002

Siviy, J. ▪ "Analyzing, Predicting, and Preventing Defects: What Does Six Sigma Add to the Equation?" *Proceedings of the IEEE Software Metrics Symposium*, Ottawa, Canada, June 4-7, 2002

Smith, J.; O'Brien, L. Gergey, J. ▪ "Using th Options Analysis for Reengineering (OAR) Method for Mining Components for a Product Line," 316-327, *Lecture Notes in Computer Science 2379: Proceedings of the Second Software Product Line Conference 2002,* San Diego, CA, August 19-22, 2002

Smith, J.; Hybertson, D. ▪ "Implementing Large-Scale COTS Reengineering within the United States Department of Defense," 245-256, *Lecture Notes in Computer Science 2255: First International Conference on COTS-Based Software Systems (ICCBSS) 2002,* Orlando, FL, February 4-6, 2002

Stafford, J.; McGregor, J. ▪ "Issues in Predicting the Reliability of Composed Components," *Proceedings of the Fifth ICSE Workshop on Component-Based Software Engineering*, Orlando, FL, May 19-20, 2002

Williams, L.; Lutz, M.; Hislop, G.; McCracken, M.; Mead, N.; Naveda, J. ▪ "Integrating Agile Practices into Software Engineering Courses," 242-243, *Proceedings of the 15th Conference on Software Engineering Education and Training (CSEE),* Covington, KY, February 25-27, 2002

JOURNAL ARTICLES

Allen, J. ▪ "Five Questions with the CERT Coordination Center's Julia Allen," *InformIT.com* (April 2002) ▪ "'Open Sesame' or Not? Use the Right Access Controls," *InformIT.com* (April 19, 2002) ▪ "Stick to the Essentials: Configuring Servers Securely," *InformIT.com* (March 2002)

Allen, J.; Rogers, L. ▪ "How Do You Know If Something's Amiss? Characterize Your Systems," *InformIT.com* (May 2002)

Allen, J.; Sledge, C. ▪ "Information Survivability: Required Shifts in Perspective," *CrossTalk 15*, 7 (July 2002): 7-9

Armstrong, J.; Barbour, R.; Hefner, R.; Kitson, D.H. ▪ "Standard CMMI Appraisal Method for Process Improvement (SCAMPI℠): Improvements and Integration," *Systems Engineering 5*, 1 (2002): 19-26

Bass, L.; John, B. ▪ "Supporting Usability Through Software Architecture," *Computer 34*, 10 (October 2001): 113-115

Bass, L.; Kazman, R. ▪ "Making Architecture Reviews Work in the Real World," *Software 19*, 1 (January/February 2002): 67-73

Boonsiri, S.; Seacord, R.; Bunting, R. ▪ "Automated Component Ensemble Evaluation," *International Journal of Information Technology 8*, 1 (August 2002)

Clements, P. ▪ "Being Proactive Pays Off," *Software 19*, 4 (July/August 2002): 28-30

Cross, S. ▪ "Software Engineering Practices: Are Software Quality and Time to Market Incompatible?" *IKSM Online* (2002)

Crnkovic, I.; Schmidt, H.; Stafford, J.; Wallnau, K. ▪ "Fourth ICSE Workshop on Component-Based Software Engineering," *ACM SIGSOFT Software Engineering Notes 26*, 6 (November 2001): 33-39

Curtis, P.; Phillips, D.; Weszka, J. ▪ "CMMI: The Evolution Continues!" *Systems Engineering: The Journal of the International Council on Systems Engineering 5*, 1 (February 2002): 7-18

Davis, N. ▪ "Using the TSP to Implement the CMM," *CrossTalk 15*, 9 (September 2002): 30

Ellison, R.; Linger, R.; Lipson, H.; Mead, N.; Moore, A. ▪ "Foundations for Survivable Systems Engineering," *CrossTalk 15*, 7 (July 2002): 10-17

Fisher, M.; Goethert, W.; Jones, L. ▪ "Applying the Software Acquisition Capability Maturity Model," *CrossTalk 15*, 8 (August 2002): 4-7

Garcia, S. ▪ "Are You Prepared for CMMI?" *CrossTalk 15*, 3 (March 2002): 19-23 ▪ "Technology Adoption and Small Businesses," *Dynamic Business 57*, 3 (April 2002): 10-11

Gopal, A.; Krishnan, M.; Mukhopadhyay, T.; Goldenson, D. ▪ "Measurement Programs in Software Development: Determinants of Success," *IEEE Transactions on Software Engineering 28*, 9 (September 2002): 863-875

Haimes, Y.; Pennock, M. ▪ "Principles and Guidelines for Project Risk Management," *Systems Engineering 5*, 2 (March/April 2002): 89-108

Hansen, W. ▪ "Defeating the Forces of Nature: Two Workshops on Spiral Development," *CrossTalk 15*, 5 (May 2002): 33

Hansen, W.; Foreman, J.; Albert, C.; Axelband, E.; Brownsword, L.; Forrester, E. ▪ "Spiral Development and Evolutionary Acquisition: The SEI-CSE Workshop," *ACM SIGSOFT Software Engineering Notes 26*, 6 (November 2001): 59

Hilburn, T.; Humphrey, W. ▪ "Teaching Teamwork," *Software 19*, 5 (September/October 2002): 72-77 ▪ "The Impending Changes in Software Education," *Software 19*, 15 (September/October 2002): 22-24

Hissam, S.; Weinstock, C.; Plakosh, D. ▪ "Trust and Vulnerability in Open Source," *IEEE Proceedings: Software: Special Issue on Open Source Software 149*, 1 (February 2002): 47-51

Householder, A.; Houle, K.; Dougherty, C. ▪ "Computer Attack Trends Challenge Internet Security," *Computer 35*, 4 (April 2002): 5-7

Ho-Won, J.; Hunter, R.; Goldenson, D.; El-Emam, K. ▪ "Findings from Phase 2 of the SPICE Trials," *Software Process Improvement and Practice 6*, 4 (December 2001): 205-242

Humphrey, W. ▪ "Five Reasons Why Software Projects Fail," *Computerworld 36*, 21 (May 2002): 50 ▪ "Software Unbundling: A Personal Perspective," *IEEE Annals of the History of Computing 24*, 1 (January-March 2002): 59-63 ▪ "Three Process Perspectives: Organizations, Teams, and People," *Annals of Software Engineering 14* (2002): 39-72 ▪ "The TSP Builds Teams and Successful Software," *CrossTalk 15*, 9 (September 2002): 3 ▪ "Why Quality Pays," *Computerworld 36*, 21 (May 2002): 49

John, B.; Bass, L. ▪ "Usability and Software Architecture," *Behavior and Information Technology 20*, 5 (2001): 329-338

Jones, L; Price, A. ▪ "Changes in Computer Science Accreditation." *Communications of the ACM 45*, 8 (August 2002): 99-103

Kang, K.; Lee, J.; Donohoe, P. ▪ "Feature-Oriented Product Line Engineering," *Software 19*, 4 (July/August 2002): 58-65

Kaindl, H.; Brinkkemper, S.; Bubenko, J.; Farbey, B.; Greenspan, S.; Heitmeyer, C.; Leite, J.; Mead, N.; Mylopoulos, J.; Siddiqi, J. ▪ "Requirements Engineering & Technology Transfer: Obstacles, Incentives, and Improvement Agenda," *Requirements Engineering Journal 7*, 3 (2002): 113-123

Lipson, H.; Mead, N.; Moore, A. ▪ "Assessing the Risk of COTS Usage in Survivable Systems," *Cutter IT Journal 15*, 5 (May 2002): 15-21

Longstaff, T.; Haimes, Y. ▪ "A Holistic Roadmap for Survivable Infrastructure Systems," *IEEE Transactions on Systems, Man and Cybernetics Part A, 32*, 2 (March 2002): 260-268

McGregor, J.; Northrop, L.; Jarrad, S.; Pohl, K. ▪ "Initiating Software Product Lines," *Software 19*, 4 (July/August 2002): 24-27

McHale, J. ▪ "TSP: Process Costs and Benefits," *CrossTalk 15*, 9 (September 2002): 26-28

Mead, N.; Saiedian, H.; Bagert, D. ▪ "Software Engineering Programs: Dispelling the Myths and Misconceptions," *Software 19*, 15 (September/October 2002): 35-41

Mead, N.; Bagert, D. ▪ "Software Engineering as a Professional Discipline," *Computer Science Education 11*, 1 (2001): 73-87

Mead, N.; Ellis, H.; Moreno, A.; Tanner, C.D.; Ramsey, D. ▪ "Characteristics of Successful Collaborations," *Computer Science Education 12*, 1-2 (2002): 119-140

Mead, N.; Linger, R.; McHugh, J.; Lipson, H. ▪ "Managing Software Development for Survivable Systems," *Annals of Software Engineering 11*, 1 (November 2001): 45-78

Northrop, L. ▪ "SEI's Software Product Line Tenets," *Software 19*, 4 (July-August 2002): 32-40

Paulish, D. ▪ "Architecture-Centric Software Project Management: An Introduction," *InformIT.com* (February 2002)

Paulk, M. ▪ "Extreme Programming from a CMM Perspective," *Software 18*, 6 (November-December 2001): 19-26

Pethia, R. ▪ "Security Issues in the Cyberspace Age," *Signal Magazine 56*, 5 (January 2002): 70

Phillips, D. ▪ "CMMI Version 1.1: What Has Changed?" *CrossTalk 15*, 2 (February 2002): 4-6

Schenker, A. ▪ "Advanced Technology: Strategic Asset or Underutilized Solution?" *Dynamic Business* (September 2002): 8-9

So, S.; Cha, S.D.; Shimeall, T.; Kwon, Y. ▪ "An Empirical Evaluation of Six Methods to Detect Faults in Software," *Software Testing Verification and Reliability 12*, 3 (September 2002): 155-171

Wallnau, K. ▪ "Wheels Within Wheels: Model Problems in Practice," *InformIT.com* (February 2002)

Williams, L.; Lutz, M.; Hislop, G.; McCracken, M.; Mead, N.; Naveda, J. ▪ "Integrating Agile Practices into Software Engineering Courses," *Computer Science Education 12*, 3 (2002): 169-185

KEYNOTE PRESENTATIONS

Carpenter, J. ▪ "United States' Experiences in Cyberspace Security," International Symposium CERT-RO, Amsterdam, The Netherlands, August 27-28, 2002

Clements, P. ▪ "Software Architecture,"Raytheon's Architecture and Architects Workshop, Plano, TX, July 9-10, 2002 ▪ "Fundamentals of Software Product Lines," DaimlerChrysler Engineers Workshop, Stuttgart, Germany, May 21, 2002

Cross, S. ▪ "Doing it Right the First Time," First Southeastern Software Engineering Conference, Huntsville, AL, April 9-10, 2002 ▪ "Advances in Software Engineering," Raytheon Systems Software Engineering Conference, Tucson, AZ, March 11-14, 2002 ▪ "Having Your Software Cake and Eating It Too," Internet Security Alliance Industry Forum, Menlo Park, CA, February 2002 ▪ "The Value of Process Improvement," Software Engineering Conference 2001, Bangalore, India, Nov. 4, 2001 ▪ "Pursue Better Software," 11th International Conference on Software Quality, Pittsburgh, PA, October 22-24, 2001

Humphrey, W. ▪ "Getting Executive Support," European Software Engineering Process Group Conference, Amsterdam, The Netherlands, April 9-12, 2002 ▪ "Setting the Agile Context," XP (Extreme Programming) Agile Universe Conference, Chicago, IL, August 5, 2002 ▪ "What if Your Life Depended on Software?" Bosch Software Conference, Stuttgart, Germany, October 7, 2002 ▪ "What If Your Life Depended on Software?" American Society for Quality Conference, Denver, CO, August 21, 2002 ▪ "What is Excellence?" Third Annual Watts Humphrey Lecture Series, Southern Polytechnic University, Marietta, GA, November 16, 2001 ▪ "What is Excellence?" NCS-Pearson Corp. Technology Summit 2002, Minneapolis, MN, January 15, 2002

Northrop, L. ▪ "Reuse That Pays," Fourth International Conference of Computer Science, Guadalajara, Mexico, March 2, 2002 ▪ "The Necessary Link Between Business Goals and Technology Choices," First International Conference on Aspect-Oriented Software Development, Enschede, The Netherlands, April 22, 2002 ▪ "Object Technology Education Today," OOPSLA (Object-Oriented Programming, Systems, Languages, and Applications) 2001 Educators' Symposium, October 15, 2001

Phillips, D. ▪ "CMMI: Improving Processes for Better Products," Semiconductor Equipment and Materials International (SEMI) Software Symposium, Peabody, MA, August 14, 2002

Zubrow, D. ▪ "Beating the Odds: Measurement and Project Success," International Function Point User Group (IFPUG) Conference, Las Vegas, NV, October 3, 2001

TUTORIALS

Allen, J. ▪ "Executive Workshop: Shifts in Thinking and Security Practices," Internet Security Alliance Annual Conference, Myrtle Beach, SC, April 8, 2002

Bachmann, F.; Bass, L. ▪ "Specifying and Achieving Non-Functional Requirements," 16th European Conference on Object-Oriented Programming, University of Málaga, Spain, June 10-14, 2002

Davis, N. ▪ "Implementing the Capability Maturity Model," Software Developer Conference West 2002, San Jose, CA, April 22-26, 2002 ▪ "Team-Directed Project Planning and Tracking," Software Developer Conference West 2002, San Jose, CA, April 22-26, 2002

Dietrich, S.; McHugh, J. ▪ "Denial of Service Attacks: Background, Diagnosis and Mitigation," 17th Annual Computer Security Applications Conference, New Orleans, LA, December 10-14, 2001

Feiler, P.; Lewis, B.; Vestal, S. ▪ "Introduction to SAE AADL," Society for Automotive Engineers (SAE) Avionics Architecture Description Language (AADL) Seminar, Toulouse, France, October 1-2, 2002

Florac, W. ▪ "Statistical Process Control for Software," Software Management/Applied Software Measurement Conference, Anaheim, CA, February 11-15, 2002

Forrester, E. ▪ "Transplant: Technology Transition Planning for Technologists," Infotech2002 29th Annual Conference and Exhibition, Omaha, NE April 22, 2002

Gabbard, D. ▪ "Threats, Vulnerabilities, and Attacks," "Prelude to a Hack," and "Cryptography and Stenography," Electronic Crime Special Agent Program (ECSAP) Conference, Las Vegas, NV, August 29, 2002

Hissam, S.; Seacord, R.; Lewis, G. ▪ "Building Systems from Commercial Components," International Conference on Software Engineering (ICSE), Orlando, FL, May 19-25, 2002

Kazman, R.; Harrison, W.; Erdogmus, H. ▪ "Fourth International Workshop on Economics-Driven Software Engineering Research," International Conference on Software Engineering (ICSE), Orlando, FL, May 19-25, 2002

Lewis, G.; Seacord, R. ▪ "Modernizing Legacy Systems," International Conference on Software Maintenance, Montreal, Canada, October 3, 2002

Little, R. ▪ "IEEE HLA Standard," Fall Simulation Interoperability Workshop (SIW), Orlando, FL, September 8-13, 2002

O'Brien L.; Smith, D. ▪ "Mining and Reengineering of Legacy Assets for Use in a New System or Product Line," Working IEEE/IFIP Conference on Software Architecture (WICSA), Montreal, Canada, August 25-31, 2002

Phillips, D.; Allgood, B. ▪ "CMMI Tutorial," National Defense Industrial Association (NDIA) CMMI Adoption Workshops, Orlando, FL, January 2002; Dallas, TX, April 2002; Seattle, WA, August 2002

Ruefle, R. ▪ "Creating and Managing a Computer Security Incident Response Team," Techno-Security 2002 Conference, Myrtle Beach, SC, April 9, 2002

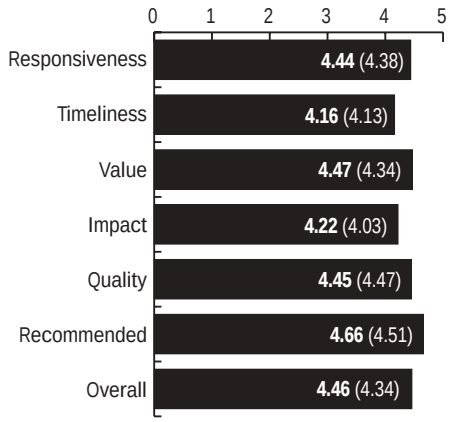
Siviy, J.; Penn, M. ▪ "Leveraging Six Sigma in Systems Engineering," International Council on Systems Engineering (INCOSE) Symposium 2002, Las Vegas, NV, July 25, 2002

Sledge, C. ▪ "Common Sense Guide for Senior Managers," Department of Commerce Fellowship Program, Washington, DC, August 28, 2002 ▪ "Information Survivability: A New Executive Perspective," Smeal College of Business, Pennsylvania State University, State College, PA, September 11, 2002

Stafford, J.; Clements, P. ▪ "Documenting Software Architectures: What, Why, and How," WICSA 2002

CUSTOMER SURVEY

Each year, the SEI and the DoD Joint Program Office ask DoD organizations that have worked with the SEI to rate the institute's work in seven categories. The chart below shows the average ratings, on a five-point scale with five being the highest, from 57 DoD and other government organizations that worked with the SEI in FY2001 (the most recent results available). The average rating from the 2000 survey is shown in parentheses.



PRESS RELEASES

The SEI issued two press releases in FY2002:[48]

September 20, 2002. Carnegie Mellon University's Software Engineering Institute Hosts TIDE Conference for Small Manufacturers ▪ Carnegie Mellon University's Software Engineering Institute (SEI) will be hosting its TIDE Conference and Exhibitor Hall on Sept. 24, 2002, at the Sheraton Four Points Hotel in Mars, PA.

July 23, 2002. Carnegie Mellon Educating Information-Security Experts with Historically Black Colleges and Hispanic-Serving Institutions ▪ Carnegie Mellon University will work with historically black colleges and universities and Hispanic-serving institutions on a program designed to create the next generation of Internet-security experts.

MEDIA COVERAGE

During this fiscal year, SEI staff members participated in 342 interviews with members of the news media. Articles appeared in more than 100 different publications, including *The New York Times, The Wall Street Journal, The Washington Post,* and *USA Today*. Staff members provided information about such topics as cyberterrorism, software quality and liability, and computer security incidents and vulnerabilities.

A selected bibliography of articles that resulted from interviews with SEI staff members follows.

Business Week ▪ "Commentary: The Best Way to Make Software Secure: Liability." March 18, 2002. Although people talk of improving computer security, they rarely discuss the most common problem. Poorly written software is the root cause of many security breaches. References CERT® Coordination Center (CERT/CC), quotes Marty Lindner. ▪ "A Chat with Worm Hunter Richard Pethia." Oct. 23, 2001. Richard Pethia discusses security breaches and viruses on the Internet in a question-and-answer session.

CIO Magazine ▪ "Who's on Your Network?" Sept. 15, 2002. This article about intrusion detection systems quotes Julia Allen and refers to the CERT/CC.

Computerworld ▪ "Privacy Bill Includes Security Rules." Sept. 27, 2002. The CERT/CC is cited as a threat-warning service that businesses might participate in under bill H.R. 4678.

Federal Computer Week ▪ "E-gov Security Gateway in Works." May 27, 2002. The General Services Administration is using an SEI assessment approach, e-Authentication risk and requirements analysis (e-RA), to analyze risks associated with a "security gateway" for e-government. This gateway will provide a single authentication point for vendors, citizens, and government employees who want to engage in transactions with the government. ▪ "Filling the Infosec Ranks." Aug. 12, 2002. Carnegie Mellon University is helping colleges and universities train the next generation of information security professionals. This article mentions the CERT/CC's role in this project.

Forbes Magazine ▪ "Attack of the Clones." June 10, 2002. This article about the Klez virus cites CERT/CC software vulnerability statistics.

IDG News Service ▪ "CERT: Security Incidents More Than Double in 2001." Jan. 11, 2002. The number of security incidents reported to the CERT/CC more than doubled in 2001 compared with the previous year, according to CERT/CC figures.

Information Week ▪ "Hackers Attacking Routers in Greater Numbers." Oct. 31, 2001. Kevin Houle of the CERT/CC explains that, although the tactic of hacking routers hasn't become widespread, it's the beginning of a new phenomenon.

Los Angeles Times ▪ "FBI Warns of Hacker Attacks from Europe." Aug. 7, 2002. This article about the FBI warning about possible attacks on Web sites and Internet providers mentions the CERT/CC and quotes Marty Lindner.

MIT Technical Review ▪ "Why Software Is So Bad." June 18, 2002. This article about the state of software engineering quotes SEI Fellow Watts Humphrey.

New York Stock Exchange Magazine ▪ "Cyber Risk." May 2002. This article about cyberterrorism and trends in computer attacks includes references to the CERT/CC and quotes Tom Longstaff.

The New York Times ▪ "Computer Security Experts Warn of Internet Vulnerability." Feb. 13, 2002. The CERT Coordination Center (CERT/CC) issued a warning about vulnerabilities involving the Simple Network Management Protocol (SNMP), a method for transferring data over computer networks. Quotes Shawn Hernan. ▪ "Cyberspace Seen as Potential Battleground." Nov. 23, 2001. Government officials are warning that cyber attacks are likely as retribution for the United States campaign in Afghanistan. The CERT/CC published a memorandum outlining the nature of the new, brawnier attacks. Quotes Kevin Houle and Jeffrey A. Hunker (dean of Carnegie Mellon's Heinz School).

Newsfactor Network ▪ "As Threat of Cyber Attacks Grows, Security Specialists Blame Faulty Software." Aug. 21, 2002. This article about the role of software quality in cyber attacks quotes Watts Humphrey extensively and mentions the SEI.

Newsweek ▪ "Hacking Grows with Internet Use." March 15, 2002. As Internet usage grows at home and at work, computer security breaches have also risen significantly—particularly in the past few years. Mentions the CERT/CC.

Pittsburgh Post-Gazette ▪ "Program Helps Smaller Manufacturers Boost Productivity—and Morale." Sept. 22, 2002. This article covers the SEI TIDE Program, citing Magdic Precision Tooling's collaboration with the program.

Scientific American ▪ "Survival in an Insecure World." May 2002. This article gives a brief background of David Fisher and discusses his work with the CERT/CC's Easel project. Mentioning Richard Pethia and Timothy Shimeall, the article emphasizes the importance of simulating unbounded systems.

USA Today ▪ "Research Group Finds Holes in Net Security." Feb. 12, 2002. The CERT/CC issued a warning about flaws in the simple network management protocol discovered last year by researchers at the University of Finland. Quotes Shawn Hernan.

Wall Street Journal ▪ "'Goner' Computer Virus Disrupts Operations at Some Corporations." Dec. 5, 2001. Antivirus companies scrambled to protect their customers against a new computer virus, dubbed "Goner," which deleted system files and clogged networks across the globe. Quotes Marty Lindner of the CERT/CC.

Washington Post ▪ "Executives Advised to Take Role in Internet Security." July 24, 2002. This article about the Internet Security Alliance's guide for protecting organizations' vulnerable networks and content references the SEI and CERT/CC and quotes Richard Pethia. ▪ "Key Players in US Government's Cybersecurity Efforts." Sept. 18, 2002. Pethia was cited as a "key player" in the government's cybersecurity efforts. Other key players include Richard Clarke, John Tritak, Ron Dick, and Phil Bond.

Many major publications featured the SEI in FY2002.

TRANSITION PARTNERS

This year, the SEI's Licensing Program strengthened its transition efforts across international borders to support the growing market for SEI licensing, research, and education in Europe. The program played an essential role in the establishment of SEI-Europe, developing new types of licensing agreements for European companies that are adopting SEI technologies internally.

At the end of the fiscal year, the Licensing Program expanded its international support by striking a brokerage agreement with the European Software Process Improvement (ESPI) Foundation. ESPI will schedule and promote SEI-authorized training in Europe, including advanced CMMI® courses delivered by the SEI and Introduction to CMMI courses delivered by SEI transition partners. There are currently nearly 50 transition partner organizations that offer CMMI training and 70 that offer SCAMPI℠ Lead Appraiser℠ services. (For more on CMMI, see page 17.)

SEI transition partners are qualified DoD and industry organizations that are authorized by the SEI to help other organizations adopt new and improved technologies—typically training courses or assessment services. Current transition partners for SEI technologies include

- some 50 organizations sponsoring 85 CMMI instructors
- 70 organizations sponsoring 122 SCAMPI Lead Appraisers
- 27 organizations sponsoring 216 instructors for Personal Software Process℠ (PSP℠) courses (39 of whom are also authorized by the SEI as Team Software Process℠ [TSP℠] Launch Coaches)

The Licensing Program also made strides in developing licensing opportunities for other SEI technologies, specifically the Architecture Tradeoff Analysis Method℠ (see page 15), the COTS Usage Risk Evaluation℠ (CURE℠, see page 20), the Operationally Critical Threat, Asset, and Vulnerability Evaluation℠ (OCTAVE℠, see page 32), and OCTAVE-S (see page 41).

The Licensing Program is the keystone of the SEI's "Amplify" strategy (see page 5), working with developers, acquirers, and transition partners to promote the adoption of best practices in the systems and software engineering community.

CERT® Coordination Center Courses

eCom Universal, Inc.
Taipei, Taiwan

ICSA.cl
Santiago, Chile

Internet Security Solutions
Taipei, Taiwan

Presecure Consulting GmbH
Telgte, Germany

Consulting Skills Workshop

ChangeShop, Inc.
Orlando, FL

Implementing Goal-Driven Software Measurement

Integrated Systems Diagnostics, Inc.
Tampa, FL

Interim Profile℠

Process Focus Management
Algonac, MI

Introduction to the Capability Maturity Model®

Abacus Technology Corporation
Chevy Chase, MD

Accenture
Internal Use Only

aimware, Ltd.
Pittsburgh, PA

American Management Systems, Inc.
Fairfax, VA

European Software Institute (ESI)
Bilbao, Spain
Non-U.S. Delivery Only

First Data Corporation
Internal Use Only

Government of India
Standardisation, Testing & Quality Certification Directorate
New Dehli, India
Non-U.S. Delivery Only

Hilbing & Associates, Inc.
Pittsburgh, PA

Integrated System Diagnostics, Inc.
Pocasset, MA

Nomura Research Institute
Tokyo, Japan
Non-U.S. Delivery Only

Process Enhancement Partners, Inc.
Franktown, CO

Software Park Thailand
Pakkred, Thailand
Non-U.S. Delivery Only

Software Technology Transition
Andover, MA

Introduction to CMMI®-SE/SW Courses

3Com
Internal Use Only

Alcyonix, Inc.
St-Bruno, Canada

Alexanna, LLC
Pittsburgh, PA

American Management Systems, Inc.
Fairfax, VA

BAE Systems
Internal Use Only

Marilyn Bush Associates
Philadelphia, PA

Center for Systems Management
Herndon, VA

ChangeBridge, Inc.
Chantilly, VA

Cooliemon, LLC
Internal Use Only

Davis Systems
Pittsburgh, PA

Gateway Associates Consulting Services
Annapolis, MD

Graffius and Associates
Hollidaysburg, PA

Griffith University
Brisbane, Australia
Non-U.S. Delivery Only

Harris Corporation
Internal Use Only

Hilbing & Associates, Inc.
Pittsburgh, PA

IBM
Southbury, CT

Institute for Software Process Improvement (ISPI)
Alexandria, VA

Integrated System Diagnostics, Inc.
Pocasset, MA

KAMO Consultancy
Pittsburgh, PA

Kasse Initiatives LLC
Plano, TX

Lockheed Martin
Gaithersburg, MD

Giuseppe Magnani
Merate, Italy
Non-U.S. Delivery Only

Martin Process Solutions, Inc.
Austin, TX

Motorola
Internal Use Only

NCR Corporation
Dayton, OH

Nomura Research Institute
Tokyo, Japan
Non-U.S. Delivery Only

Process Assessment, Consulting & Training
Burnsville, MN

Process Enhancement Partners, Inc.
Franktown, CO

Process Focus Management
Algonac, MI

The Process Group
Dallas, TX

Process Inc.
Ottawa, Canada

Process Strategies, Inc.
Walpole, ME

Process Transition International, Inc.
Annapolis, MD

QAI India, Ltd.
New Delhi, India
Non-U.S. Delivery Only

Q-Labs, Inc.
Greenbelt, MD

Raytheon Company
Internal Use Only

Reuters, Ltd.
Internal Use Only

Science Applications International Corporation (SAIC)
Beavercreek, OH

SECAT LLC
La Mirada, CA

Siemens
Internal Use Only

SITARA Technologies Pvt., Ltd.
Bangalore, India
Non-U.S. Delivery Only

Software Productivity Consortium
Herndon, VA

Software Systems Quality Consulting - SSQC
San Jose, CA

Software Technology Transition
Andover, MA

StepUp Solutions, Inc.
Los Gatos, CA

Synchro Cubed
Henderson, NV

TeraQuest Metrics, Inc.
Austin, TX

TRW
Internal Use Only

Operationally Critical Threat, Asset and Vulnerability Evaluation℠ (OCTAVE℠) Method Services and Training

Advanced Technology Institute
Charleston, SC

SCS Secure Communications Solutions, Inc.
Pittsburgh, PA

Sytel, Inc.
Bethesda, MD

Xceed Consulting
Pittsburgh, PA

People Capability Maturity Model® Lead Assessor Training

TeraQuest Metrics, Inc.
Austin, TX

Personal Software Process℠ (PSP℠), Team Software Process℠ (TSP℠), and Launch Coach Training

ABB
Internal Use Only

Advanced Information Services, Inc.
Peoria, IL

Advanced Maturity Services
Atlanta, GA

Applied Research Lab-University of Texas
Internal Use Only

Centro de Investigacion en Matematicas
Guanajuato, Mexico

Davis Systems
Pittsburgh, PA

Defense Logistics Agency
Englewood, CO
PSP Only
U.S. Government Use Only

DPC Cirrus
Internal Use Only

EBS Dealing Resources
Internal Use Only

Honeywell
Internal Use Only

IBM
Southbury, CT

Alan S. Koch, Consultant
Natrona Heights, PA

KPMG
Chennai, India
Non-U.S. Delivery Only

Lockheed Martin
Internal Use Only

M/A-Com Private Radio Systems, Inc.
Internal Use Only

Microsoft
Internal Use Only

NAVAIR
China Lake, CA
PSP Only
U.S. Government Use Only

Prodigia S.A. de C.V.
Mexico City, Mexico

PS&J - Software Six Sigma
Leonia, NJ

QuarkSoft S.C.
Mexico

Samsung SDS
Internal Use Only

Science Applications Internation Corp (SAIC)
Arlington, VA

STPP, Inc.
Bradford Woods, PA

STSC
Hill AFB, UT
PSP Only
U.S. Government Use Only

Trilogy
Internal Use Only

United Defense Industries, Inc.
Internal Use Only

Xerox
Internal Use Only

Publications Distribution

Auerbach Publications
New York, NY

Defense Technical Information Center (DTIC)
Ft. Belvoir, VA

National Technical Information Service (NTIS)
U.S. Department of Commerce
Springfield, VA

SCAMPI℠ Appraisal Services

3Com
Internal Use Only

ABB
Internal Use Only

Alcyonix, Inc.
St-Bruno, Canada

Alexanna, LLC
Pittsburgh, PA

ALSTOM Technologies
Meudon-La-Foret, France
Non-U.S. Delivery Only

American Management Systems, Inc.
Fairfax, VA

BAE SYSTEMS
Frimley, United Kingdom
Non-U.S. Delivery Only

Marilyn Bush Associates
Philadelphia, PA

Center for Systems Management
Herndon, VA

Cepeda Systems & Software Analysis, Inc. (CSSA)
Madison, AL

ChangeBridge, Inc.
Chantilly, VA

Computer Sciences Corp. (CSC)
Newark, DE

Comskil, Inc.
Bethesda, MD

Cooliemon, LLC
Harmony, PA

Cyber Keji Park, Inc.
Austin, TX

Don Franke Associates
Manchester, MO

The Dunaway Group
Addison, TX

Effective Process Solutions
Morrison, CO

Electronic Data Systems (EDS)
Plano, TX

European Software Institute (ESI)
Bilbao, Spain
Non-U.S. Delivery Only

Fujitsu Limited
Chiba City, Japan
Non-U.S. Delivery Only

General Motors
Internal Use Only

Griffith University
Brisbane, Australia
Non-U.S. Delivery Only

Harris Corporation
Internal Use Only

Hilbing & Associates, Inc.
Pittsburgh, PA

Hitachi Software Engineering
Tokyo, Japan
Non-U.S. Delivery Only

IBM
Southbury, CT

i-flex Solutions, Inc.
Mumbai, India
Non-U.S. Delivery Only

Intel Corporation
Internal Use Only

Integrated System Diagnostics, Inc.
Pocasset, MA

KAMO Consultancy
Pittsburgh, PA

KPMG
Chennai, India
Non-U.S. Delivery Only

Bearing Point
McLean, VA

Lockheed Martin
Gaithersburg, MD

LogiQual, Inc.
St-Lambert, Canada

Martin Process Solutions, Inc.
Austin, TX

Motorola
Internal Use Only

Multi-Dimensional Maturity
Celina, TX

NCR Corporation
Dayton, OH

NEC Corporation
Tokyo, Japan
Non-U.S. Delivery Only

Norimatsu Process Engineering Laboratory, Inc.
Tokyo, Japan
Non-U.S. Delivery Only

Nomura Research Institute
Tokyo, Japan
Non-U.S. Delivery Only

Northrop Grumman Corporation
Baltimore, MD

Objective SST Corporation
Ottawa, Ontario, Canada

Process Inc.
Ottawa, Ontario, Canada

Process Advantage Technology, Inc.
Benicia, CA

Process Assessment, Consulting & Training
Burnsville, MN

The Process Company, LLC
Springfield, VA

Process Enhancement Partners, Inc.
Franktown, CO

Process Focus Management
Algonac, MI

Process Plus, Inc.
Richboro, PA

Process Strategies, Inc.
Walpole, ME

Process Transition International, Inc.
Annapolis, MD

ProcessVelocity, LLP
San Diego, CA

QAI India, Ltd.
New Delhi, India
Non-U.S. Delivery Only

Q-Labs, Inc.
Greenbelt, MD

Quality Assurance Institute Middle East and Africa
Dubai, United Arab Emirates
Non-U.S. Delivery Only

Quality Point Integrating Systems Private, Ltd.
Gill Nagar, Chennai, India
Non-U.S. Delivery Only

Raytheon Company
Sudbury, MA

Reuters, Ltd.
Internal Use Only

RING Associates
Austin, TX

John F. Ryskowski Consulting
Manhattan Beach, CA

Science Applications International Corporation (SAIC)
Beavercreek, OH

Siemens AG
Munich, Germany

SITARA Technologies Pvt., Ltd.
Bangalore, India
Non-U.S. Delivery Only

Sodalia SPA
Trento, Italy
Non-U.S. Delivery Only

Software Productivity Consortium
Herndon, VA

Software Quality Center, Inc.
Bangalore, India
Non-U.S. Delivery Only

Software Research Associates, Inc.
Tokyo, Japan
Non-U.S. Delivery Only

Software Systems Quality Consulting - SSQC
San Jose, CA

Software Technology Transition
Andover, MA

Soza and Company, Ltd.
Fairfax, VA

SPI Consulting Company
San Jose, CA

SSI Technologies
Chennai, India

StepUp Solutions, Inc.
Los Gatos, CA

Synchro Cubed
Henderson, NV

Synchro PP&T, Inc.
El Toro, CA

TCS America
Naperville IL

TeraQuest Metrics, Inc.
Austin, TX

THALES
Orsay Cedex, France

TRW
Redondo Beach, CA

United States Air Force CRSIP STSC
Hill AFB, UT
U.S. Government Use Only

Yazaki Corporation
Susono, Shizuoka Pref. Japan

Software Capability Evaluation Team Training

Abacus Technology Corporation
Chevy Chase, MD

Institute for Software Process Improvement (ISPI)
Alexandria, VA

Intel Corporation
Internal Use Only

Integrated System Diagnostics, Inc.
Pittsburgh, PA

WORK WITH DoD SOFTWARE COLLABORATORS

The DoD Software Collaborators[44] are a network of providers of software research, services, and products that help both program managers and software developers.

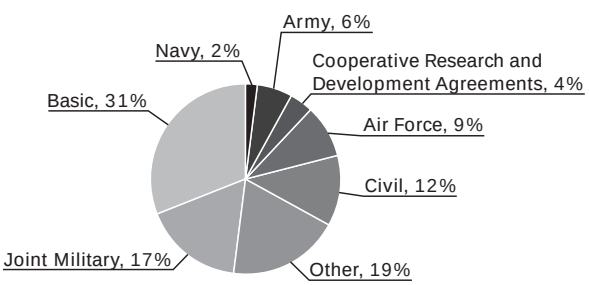
In FY2002, the SEI hosted the DoD Software Collaborators Workshop (see page 45) and worked with many organizations in the network, including

- Aviation and Missile Command (AMCOM) Software Engineering Directorate
- Communications-Electronics Command (CECOM) Software Engineering Center
- Computer Resources Support Improvement Program (CRSIP)
- Defense Acquisition University (DAU)
- Defense Contract Management Agency (DCMA) Software Center
- MITRE Corporation
- Naval Air Warfare Center (NAVAIR)
- Naval Postgraduate School (NPS)
- Practical Software Measurement (PSM)
- Space and Naval Warfare Systems Command (SPAWAR) Center San Diego (SSC SD)

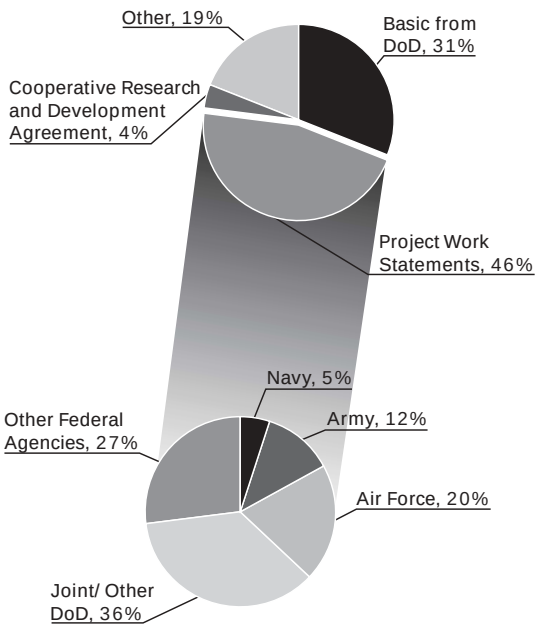
FUNDING FOR FY2002 AND SUPPORT FOR THE SEI'S DoD SPONSORS

The SEI received $51.6 million in funding for FY2002. The two charts below show this funding arranged by funding organizations and by type of funding. A "project work statement" (PWS) is a task order from a specific government program to perform specific work. A "cooperative research and development agreement" (CRADA) is an agreement with industry and academic collaborators. "Basic" funding is funding provided by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, the SEI's primary DoD sponsor, to execute the SEI technical program. "Other" funds come from course and conference fees, and other recovered costs.

FY2002 Funding by Organization



FY2002 Funding by Type



THE SEI MEMBERSHIP PROGRAM

In 1992, the SEI established a program, now called the SEI Membership Program, designed to enable software engineering managers and practitioners to keep closely connected to the SEI's latest news and information. For the past 10 years, SEI members from around the globe have been able to access the SEI's repositories of information and research results.

SEI members enjoy a weekly email newsletter, *The Bulletin*, and have access to a members-only Web site, called the Member Center, where they can find the latest news, browse the profiles of fellow members in the member directory, and in the near future, listen to presentations from members of the SEI technical staff. Members also enjoy savings on the Software Engineering Process Group (SEPG) Conference, SEI merchandise, and one SEI public course offering per year.

Since the program's inception, the SEI has offered the membership program to individuals from industry, government, and academia in the U.S. This past year, the program was opened to international applicants.

REFERENCES TO ONLINE INFORMATION

1 http://www.standishgroup.com/reports/reports.php
2 http://www.isalliance.org
3 http://www.sei.cmu.edu/products/publications/sei.series.html
4 http://www.sei.cmu.edu/programs/acquisition-support/
5 http://www.sei.cmu.edu/ata/ata_init.html
6 http://www.sei.cmu.edu/products/courses/courses.html
7 http://www.sei.cmu.edu/cmmi/
8 http://www.sei.cmu.edu/publications/documents/01.reports/01hb001.html
9 http://www.sei.cmu.edu/pub/documents/02.reports/pdf/02hb002.pdf
10 http://www.sei.cmu.edu/cmm-p/
11 http://www.sei.cmu.edu/arm/SA-CMM.html
12 http://www.sei.cmu.edu/cbs/cbs_description.html
13 http://www.sei.cmu.edu/cbs/products.html#CURE
14 http://www.sei.cmu.edu/cbs/epic/
15 http://www.sei.cmu.edu/publications/documents/02.reports/02tr009.html
16 http://www.sei.cmu.edu/publications/documents/02.reports/02tr005.html
17 http://www.iccbss.org/
18 http://www.sei.cmu.edu/pcs/pcs.html
19 http://www.sei.cmu.edu/pacc/index.html
20 http://www.eia.org/news/pressreleases//2002-03-20.52.phtml
21 http://www.sei.cmu.edu/plp/plp_init.html
22 http://www.sei.cmu.edu/plp/framework.html
23 http://www.sei.cmu.edu/plp/companion.html
24 http://www.sei.cmu.edu/publications/documents/02.reports/02tn012.html
25 http://www.sei.cmu.edu/sema/welcome.html
26 http://www.sei.cmu.edu/sema/profile.html
27 http://www.sei.cmu.edu/programs/nss/nss.html
28 http://www.cert.org/
29 http://www.cert.org/kb/aircert/
30 http://www.networkmagazine.com/article/NMG20020401S0002/1
31 http://www.cert.org/advisories/CA-2002-03.html
32 http://www.cert.org/octave/
33 http://www.sei.cmu.edu/products/publications/cert-books.htm#octave
34 http://www.sei.cmu.edu/tsp/
35 http://www.sei.cmu.edu/products/courses/tsp-exsem.html
36 http://www.sei.cmu.edu/publications/documents/02.reports/02tn019.html
37 http://www.sei.cmu.edu/publications/documents/02.reports/02tr020.html
38 http://www.sei.cmu.edu/publications/documents/02.reports/02tr023.html
39 http://www.sei.cmu.edu/publications/documents/01.reports/01tn004.html
40 http://www.sei.cmu.edu/tide/
41 http://www.sei.cmu.edu/ttp/
42 http://www.sei.cmu.edu/products/events/ttw/
43 http://www.sei.cmu.edu/publications/documents/02.reports/02sr027.html
44 http://www.dacs.dtic.mil
45 http://www.sei.cmu.edu/SPLC2/
46 http://www.sei.cmu.edu/sepg/
47 http://www.sei.cmu.edu/products/events/euro.sepg/
48 http://www.sei.cmu.edu/about/press/pressreleasesmain.html

ABBREVIATIONS, ACRONYMS, AND INITIALISMS

AADL	Avionics Architecture Description Language
ABET	Accreditation Board for Engineering and Technology
ACM	Association for Computing Machinery
ACSAC	Annual Computer Security Applications Conference
AFMSS	Air Force Mission Support System
AirCERT	Automated Incident Reporting-CERT
AIAA	American Institute of Aeronautics and Astronautics
AMCOM	Army's Aviation and Missile Command
AMP	Avionics Modernization Program
ARC	Appraisal Requirements for CMMI®
ARPA	Advanced Research Projects Agency
ASA ALT	Assistant Secretary of the Army for Acquisition, Logistics and Technology
ASD	Avionics Embedded Systems Division
ASP	Acquisition Support Program
ASQ	American Society for Quality
ATAM℠	Architecture Tradeoff Analysis Method℠
ATD	advanced technology demonstration
C3I	command, control, communications, and intelligence
CAD	computer-aided design
CAE	computer-aided engineering
CAiSE	Conference on Advanced Information Systems Engineering
CCS-C	Command and Control System Consolidation
CCSS	Command and Control Systems School
CD	compact disk
CeBASE	Center for Empirically Based Software Engineering
CECOM	Communications-Electronics Command
CEO	chief executive officer
CERT®/AC	CERT® Analysis Center
CERT®/CC	CERT® Coordination Center
CIO	chief information officer
CMM®	Capability Maturity Model®
CMMI®	Capability Maturity Model Integration
CMMI®-SE/SW	Capability Maturity Model®-Integrated for Systems Engineering/Software Engineering
CMS	Center for Medicare and Medicaid Systems
COE	common operating environment
COTS	commercial off-the-shelf
CR	capture–recapture
CRADA	cooperative research and development agreement
CRSIP	Computer Resources Support Improvement Program
CSC	Computer Sciences Corporation
CSEE	Conference on Software Engineering Education and Training
CSIRT	computer security incident response team
CSPI	Critical Systems Protection Initiative
CURE℠	COTS Usage Risk Evaluation℠
DARPA	Defense Advanced Research Projects Agency
DAU	Defense Acquisition University
DCAPES	Deliberate and Crisis Action Planning and Execution Segment
DCMA	Defense Contract Management Agency
DDoS	distributed denial of service
DFAS	Defense Finance and Accounting Service
DNS	domain name system
DoD	Department of Defense
DTIC	Defense Technical Information Center
EA	evolutionary acquisition
ECOOP	European Conference on Object-Oriented Programming
ECSAP	Electronic Crime Special Agent Program
EDS	Electronic Data Systems
EIA	Electronic Industries Alliance
EPIC℠	Evolutionary Process for Integrating COTS-Based Systems℠
e-RA	e-Authentication risk and requirements analysis
ESC	Electronic Systems Center
ESC/AC	Electronic Systems Center/Combat Air Forces Command and Control
E-SEPG	European Software Engineering Process Group℠
ESI	European Software Institute
ESPI	European Software Process Improvement
FBCB2	Force XXI Battle Command Brigade and Below
FCS	Future Combat Systems
FY	fiscal year
GSAW	Ground System Architecture Workshop
GUI	graphical user interface
HB	handbook
HLA	high-level architcture
ICCBSS	International Conference on COTS-Based Software Systems
ICSE	International Conference on Software Engineering
IEEE	Institute of Electrical and Electronics Engineers
IFIP	International Federation for Information Processing
IFPUG	International Function Point User Group
INCOSE	International Council on Systems Engineering
IPD	integrated product development
IPPD	integrated product and process development
IR&D	independent research and development
ISAT	Information Science and Technology
ISO	International Organization for Standardization
ISPI	Institute for Software Process Improvement

IT	information technology
ITA	independent technical assessment
ITMS	Information Technology Metrics Strategy
IWCASE	International Workshop on Computer-Aided Software Engineering
JMPS	Joint Mission Planning System
JSIMS	Joint Simulation System
KLOC	thousand source lines of code
MAP	Mining Assets for Product Lines
MFR	multi-function radar
MilPDS	Military Personnel Data System
MILSATCOM	Military Satellite Communications
MISRT	Medical Information Security Readiness Team
NASA	National Aeronautics and Space Administration
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NDIA	National Defense Industrial Association
NNTP	network news transport protocol
NPS	Naval Postgraduate School
NRC	National Research Council of Canada
NRO	National Reconnaissance Office
NSERC	Natural Sciences and Engineering Research Council
NSF	National Science Foundation
NTIS	National Technical Information Service
NUWC	Naval Undersea Warfare Center
OCTAVE℠	Operationally Critical Threat, Asset, and Vulnerability Evaluation℠
OCTAVE-S	Operationally Critical Threat, Asset, and Vulnerability Evaluation℠ for Small Businesses
OOPSLA	Object-Oriented Programming, Systems, Languages, and Applications
OSD	Office of the Secretary of Defense
OUSD (A&T)	Office of the Under Secretary of Defense for Acquisition and Technology
OUSD (AT&L)	Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics
PACC	Predictable Assembly from Certifiable Components
PAIS	Process Appraisal Information System
PCIPB	President's Critical Infrastructure Protection Board
P-CMM	People Capability Maturity Model
PECT	prediction-enabled component technology
PEO/SYSCOM	Program Executive Officer/System Commander
PLP	Product Line Practice
PLTP℠	Product Line Technical Probe℠
POSIX	Portable Operating System Interface
PSM	Practical Software Measurement
PSP℠	Personal Software Process℠
PWS	project work statement
QSM	Quantitative Software Management
R&D	research and development
RMA	rate monotonic analysis
SA-CMM	Software Acquisition Capability Maturity Model
SAE	Society of Automotive Engineers
SAIC	Science Applications International Corporation
SCAMPI℠	Standard CMMI Appraisal Method for Process Improvement
SCE℠	software capability evaluation
SCS	School of Computer Science
SEC	Software Engineering Center
SE-CMM	Systems Engineering Capability Maturity Model
SEI℠	Software Engineering Institute
SEIR	Software Engineering Information Repository
SEMI	Semiconductor Equipment and Materials International
SEPG℠	Software Engineering Process Group
SERP	software engineering research and practice
SESC	Software Engineering Standards Committee
S&ET	Science and Engineering Technology
SIGPLAN	ACM Special Interest Group for Programming Languages
SIM	security improvement module
SIP	strategic impact program
SIW	Simulation Interoperability Workshop
SNMP	simple network management protocol
SPAWAR	Space and Naval Warfare Systems Command
SPLC	Software Product Lines Conference
SPS	Standard Procurement System
SR	special report
SSC SD	SPAWAR Systems Center San Diego
STEP	Software Technology and Engineering Practices
STO	Science and Technology Objective
STSC	Software Technology Support Center
SW-CMM	Capability Maturity Model for Software
TCM	technology change management
TIDE	Technology Insertion, Demonstration, and Evaluation
TN	technical note
TR	technical report
TRL	technology readiness level
TTP	Technology Transition Practices
TSP℠	Team Software Process℠
UML	Unified Modeling Language
USC-CSE	University of Southern California Center for Software Engineering
USSS	United States Secret Service
WICSA	Working IEEE/IFIP Conference on Software Architectures
WP	work practice
XP	extreme programming
Y2K	year 2000

The Software Engineering Institute (SEI[SM]) is operated by Carnegie Mellon University for the Department of Defense. As such, the following conditions apply:

Editor in Chief	Bill Pollak
Editorial Staff	Hollen Barmer
	Laura Bentrem
	Carol Biesecker
	Pamela Curtis
	Claire Dixon
	Erin Harper
	Lauren Heinz
	Bill McSteen
	Bill Thomas
	Pennie Walters
	Barbara White
Art Director	Stacy Mitchell
Production Designers	Jeannine Caracciolo
	Robert Fantazier
Photography	ABB Ltd.
	Ken Andreyo
	General Dynamics Land Systems Division
	Tim Kaulen
	Northrop Grumman
	Sikorsky Aircraft
	U.S. Army
Production Editor	David Gregg

Software Engineering Institute
Carnegie Mellon University
4500 Fifth Avenue
Pittsburgh, PA 15213-3890

Phone: 412-268-5800
Fax: 412-268-5758
http://www.sei.cmu.edu

Other offices

Arlington Site
NRECA Building, Suite 902
4301 Wilson Boulevard
Arlington, VA 22203

SEI-Europe[SM]
Office 550
An der Welle 4
60 322 Frankfurt, Germany

U.S. Army Aviation and Missile Command
AMSAM-BA Bldg 6263
Redstone Arsenal, AL 35898