



ACQUISITION

ARCHITECTURE

ASP

ATAM

CERT/CC

CMMI

COTS

CREDENTIALS

CURE

ICCBSS

OCTAVE

PCS

PLTP

PRODUCT LINES

PSP

SCAMPI

SECURITY

SEI-EUROPE

SEIR

SEMA

SEPG

SOFTWARE

SPINS

SPLC

SYSTEMS INTEGRATION

SYSTEM OF SYSTEMS

TRANSITION

TSP

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*Software engineering is the technological and managerial discipline concerned with systematic production and maintenance of software products that are developed and modified on time and within cost estimates.*

**Fairley, R. *Software Engineering Concepts***  
New York: McGraw-Hill, 1985

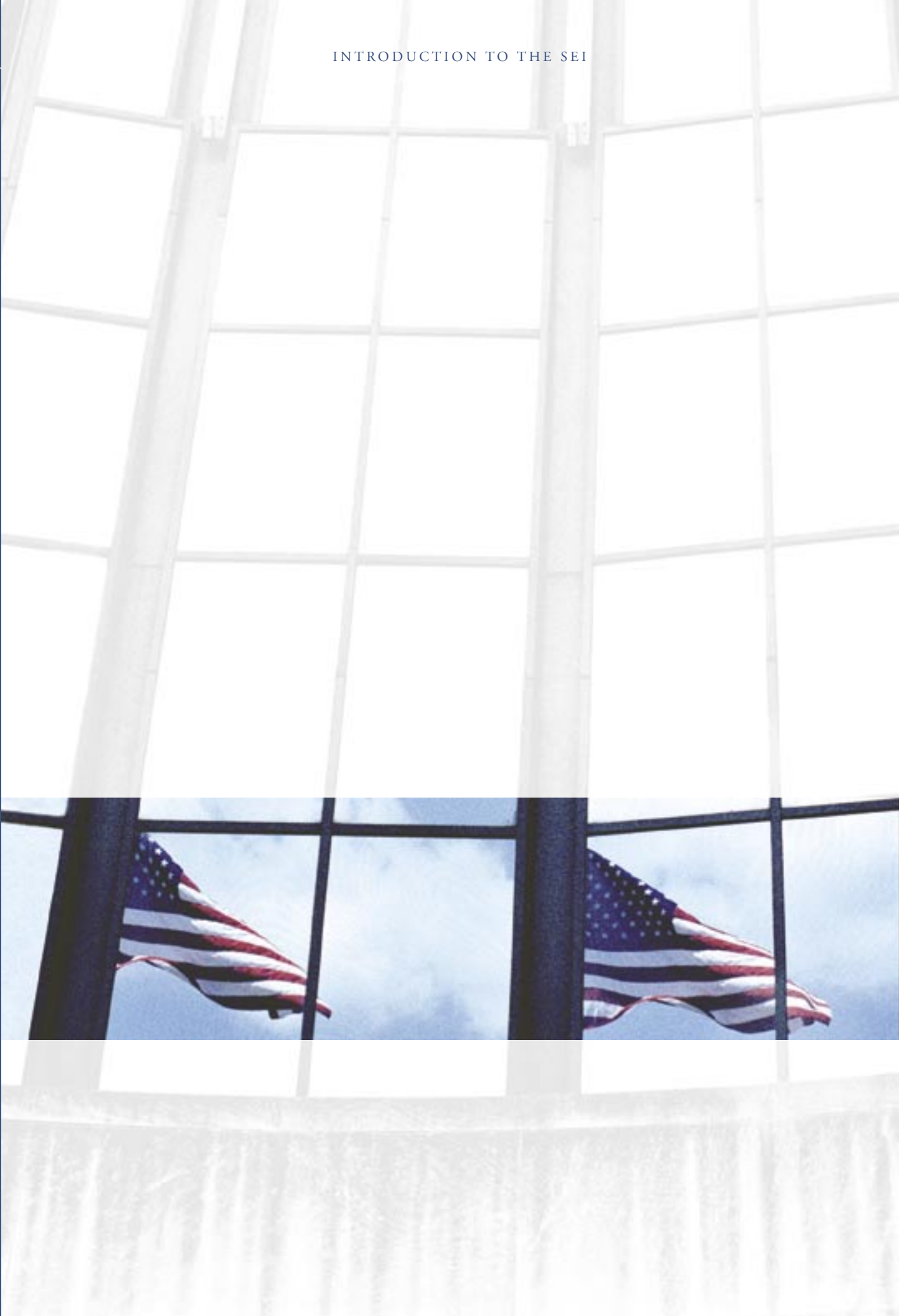
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## VISION

The SEI's core purpose is to help others make measured improvements in their software engineering capabilities and to develop 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.

INTRODUCTION TO THE SEI





## MESSAGE FROM THE DIRECTOR

### Establishment of the SEI

Quality software that is produced on schedule and within budget is a critical component of U.S. defense systems. For this reason, the U.S. Department of Defense (DoD) established the Carnegie Mellon® Software Engineering Institute (SEI) in 1984 to advance the practice of software engineering. Before 1984, a number of commissions with representatives from government, industry, and academia had called for the creation of a software engineering institute, funded by the DoD, that would be a national resource in software engineering and technology and respond to a perceived crisis in software quality and management. History has proven those who first conceived the idea of a software engineering institute to have been prescient; almost 20 years later, the importance of software to our economy and national defense is greater than it ever has been.

The SEI was conceived to be administered by a university and chartered as a federally funded research and development center (FFRDC). Unlike other FFRDCs such as Lincoln Laboratories or the NASA Jet Propulsion Laboratory, the SEI's location was opened to competitive bidding. More than 40 universities prominent in computer science and with established expertise in software engineering responded to the government's request for proposals. As provost of Carnegie Mellon University at that time, I led the team at Carnegie Mellon that put together the winning proposal and organized a team of computer scientists and technologists to form the nucleus of the SEI.

The SEI has evolved through many phases over the years, responding to the changing needs of its DoD sponsor, some not anticipated in the SEI's original charter. Through all of these phases, the SEI has remained true to its primary technology-transition mission—to transform software engineering from an ad hoc, labor-intensive activity to a managed, technology-supported engineering discipline so that the government can acquire software-intensive systems from a broader, more capable contractor base. Through the years, the SEI has explored promising solutions to significant problems, identified the best solutions, tested them to determine their value, and worked to ensure that these solutions are widely disseminated and adopted in the practice of software engineering throughout industry, government, and academia.

**Angel Jordan**  
Acting Director



1985

**MESSAGE FROM THE DIRECTOR, CONTINUED****Early Years**

Nico Haberman, a respected computer scientist and software engineer and chair of the Department of Computer Science at Carnegie Mellon, served as the SEI's first acting director. In 1985, I succeeded John Manley, the SEI's first director, and served as acting director of the SEI while remaining as provost of Carnegie Mellon during a period of transition. A year later, a prominent software engineer, Larry Druffel, was named permanent director of the SEI. Until his departure in 1996 to pursue a new position of leadership in another institution, Dr. Druffel directed the institute through a period of significant growth and progress. Some of the SEI's best-known achievements during Dr. Druffel's tenure are the following:

1987

- In 1987, the SEI developed a model curriculum for a master's degree program in software engineering that was adopted by universities across the country.
- Also in 1987, the SEI published the first version of the Capability Maturity Model® for Software (SW-CMM®) framework, a model for assessing the maturity of the software processes of an organization and for identifying the practices that are required to increase the maturity of these processes. The SW-CMM has been adopted by more than 5,000 organizations globally, and the SEI has granted more than 200 licenses to organizations and individuals to provide products and services to the process-improvement market that has grown from the SW-CMM.

1988

- The CERT® Coordination Center (CERT®/CC) was established at the SEI in 1988 after the "Internet Worm" incident, in which a college student released a self-replicating program on the Internet that disabled about 10% of the computers connected to the network. The CERT/CC was conceived as a computer emergency response team to coordinate communication among experts during security emergencies and to help prevent future incidents. Since then, the CERT/CC has responded to more than 320,000 incidents from organizations and individuals throughout the world and maintained worldwide leadership in analyzing vulnerabilities and threats to critical networked infrastructures (see page 46).

1993

- The SEI's first Software Engineering Process Group (SEPG<sup>SM</sup>) conference was held in 1988. The SEI SEPG, a public forum dedicated to the wide dissemination of best software engineering practices, is the leading international conference and exhibit showcase for software process improvement (see page 74).

1996

- The SEI introduced the SEI Personal Software Process<sup>SM</sup> (PSP<sup>SM</sup>) methodology in 1993 to encourage individual software engineers to use disciplined processes. SEI PSP led in 1996 to the Team Software Process<sup>SM</sup> (TSP<sup>SM</sup>) methodology, which helps software teams predict and meet development schedules and develop software with unprecedented accuracy and quality (see page 40).

2002





Larry Druffel

## MESSAGE FROM THE DIRECTOR, CONTINUED

### Recent Accomplishments

After Dr. Druffel's departure, Julia Allen, currently a senior member of the SEI technical staff working in Internet security, served as interim director before the arrival of Stephen E. Cross in November 1996. Dr. Cross, a well-known research scientist with extensive DoD experience, ably guided the SEI in a rapidly changing environment. When he announced his decision during the past year to pursue another leadership opportunity, Dr. Cross left behind a legacy of achievement and increased worldwide impact for the SEI.



Julia Allen

- The success of the SW-CMM spawned additional CMMs in related domains. Responding to the demand for better integration of CMMs, training, and assessment methods, the Office of the Under Secretary of Defense for Acquisition and Technology initiated the Capability Maturity Model Integration (CMMI<sup>®</sup>) project, cosponsored by the National Defense Industrial Association, in 1998. CMMI represents the next stage in the evolution of the maturity model concept that began with the SW-CMM (see page 33).



Stephen Cross

- Responding to a DoD mandate for use of commercial off-the-shelf (COTS) software products when building DoD systems, the SEI worked to define improved acquisition practices. In 2000, the SEI developed the SEI COTS Usage Risk Evaluation<sup>SM</sup> (CURE<sup>SM</sup>) method to help program managers oversee COTS-based programs.
- The SEI improved software engineering practices in the areas of architecture-based design and product line practice, developing the SEI Architecture Tradeoff Analysis Method<sup>SM</sup> (ATAM<sup>SM</sup>) evaluation process, a method for identifying the relationships and tradeoffs among quality attributes such as modifiability, interoperability, and security; and the *SEI Framework for Software Product Line Practice<sup>SM</sup>*, a Web-based compendium of activities and practices necessary to succeed with software product lines.
- In 2002, the SEI established an Acquisition Support Program to work directly with key DoD and other government entities to improve acquisition of software-intensive systems.

Since Dr. Cross's departure, I have again been privileged to serve the SEI as acting director during our search for a new director. The pages that follow detail the work that we have done at the SEI during the past fiscal year and chart our future direction as we continue to pursue our vision for software engineering: the right software, delivered defect free, on time and on cost, every time. We thank you for reading.

*Angel G. Jordan*

**MISSION**

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 is a preeminent software engineering research and development center. The SEI mission includes four objectives:

**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

**Maintain**

a long-term competency in software engineering and technology transition

**Enable**

industry and government organizations to make measured improvements in their software engineering practices by working with them directly

**Foster**

the adoption and sustained use of standards of excellence for software engineering practice

## STRATEGY

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

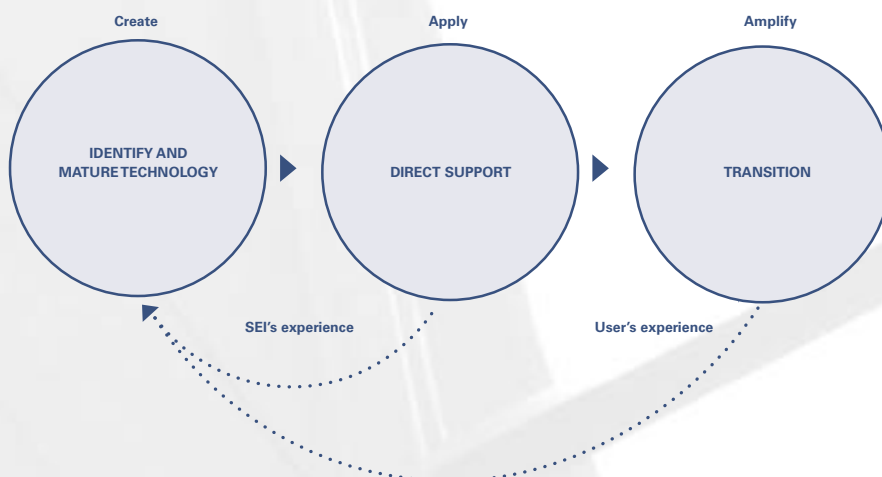
The SEI works with leading-edge software developers and acquirers to apply and validate the new and improved practices.

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 SEI Partners—DoD and industry organizations that help others adopt new technology.



## HIGHLIGHTS 2003

This report details work performed at the SEI in FY 2003 in support of its mission. Below are some highlights.

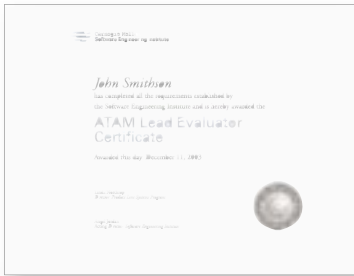


The CERT Coordination Center (CERT/CC) resolved more than 137,500 unique cyber security incidents (a 67% increase from 2002) and received reports on 3,784 vulnerabilities. The CERT/CC is mentioned six times in *The National Strategy to Secure Cyber Space* ([www.whitehouse.gov/pcipb](http://www.whitehouse.gov/pcipb))—more than any other organization. In September 2003, the Department of Homeland Security announced the creation of the United States-Computer Emergency Readiness Team (US-CERT), a joint effort with the CERT/CC. US-CERT was established to protect the nation's Internet infrastructure.

The SEI continued to provide systems engineering and software engineering support to DoD programs identified as top priorities by the principal SEI sponsor, the Office of the Under Secretary of Defense (Acquisition, Technology, & Logistics), and to increase interaction and support to DoD agencies and joint programs. For example, the Army "after action" reports following the 2003 war in Iraq underscored the positive results of the exhaustive architecture study that the SEI performed on the Force XXI Battle Command Brigade and Below (FBCB2) system—the principal tactical digital command-and-control system for the U.S. Army. SEI product line and architecture methods have been adopted by the contractor for the system, Northrop Grumman, and are being applied directly to the FBCB2 system.

Responding to a strategic planning workshop held with the DoD in March 2003, the SEI also conducted a research and development project in FY 2003 that examined system-of-systems interoperability. In this study, the SEI identified barriers to achieving interoperability among systems, including programmatic, constructive, and technical problems, and proposed solutions to those problems.

In an article written by R. L. Glass and T. Y. Chen for the *Journal of Systems and Software* 68 (2003), 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 10th in an annual series in the journal. It includes five years of data (1998-2002) and is based on the frequency of publication in the following journals: *Information and Software Technology*, *Journal of Systems and Software*, *Software Practice and Experience*, *Software, Transactions on Software Engineering and Methodologies*, and *Transactions on Software Engineering*.



The SEI developed credentials programs in computer-security incident handling, software engineering process management, and software architecture that guide participants through a series of courses chosen to help them develop expertise in specific areas of work. Currently, the SEI offers seven certificate programs and one certification program; other programs are in development. Completing an SEI certificate or certification program gives software engineers and process improvement professionals official recognition of their skills and expertise. For more information, see [www.sei.cmu.edu/products/courses/certificates](http://www.sei.cmu.edu/products/courses/certificates).



This year, the SEI enhanced the support that it provides to those responsible for acquiring software in the Army, Air Force, and Navy, working with each service to establish a strategic impact program (SIP) for software-intensive systems. A SIP is a multiyear program of work, a strategic commitment to improvement and change within an acquisition community and industry base. The goal is to contribute to the success of acquisition programs that fall within the scope of a military service SIP.

For example, the SEI helped the U.S. Army develop its Strategic Software Improvement Master Plan, which identifies improvement initiatives to be undertaken in each fiscal year and thereby provides a roadmap for program execution. The Air Force SIP is working closely with the Space and Missile Systems Center and the Electronics Systems Center. And the Navy SIP is working with Navy and Marine Corps organizations, identifying opportunities to support them and to apply SEI technologies, tools, and methods.



Attendance increased at the SEI's Capability Maturity Model Integration (CMMI) and security-related education and training courses. CMMI course attendance increased by more than 60% in FY 2003. More than 11,000 people have received training in CMMI, including 5,756 people who attended the Introduction to CMMI course in FY 2003. There was also a 17% increase in the number of SEI Partners licensed to teach Introduction to CMMI, and a 59% increase in SEI Partners licensed to conduct CMMI appraisals. Course attendance at the SEI's security-related courses more than doubled, from 400 in FY 2002 to 950 in FY 2003.





**ACQUISITION SUPPORT PROGRAM (ASP)**

Acquiring systems that deliver mission capabilities on their promised date is a national imperative. DoD acquisition programs frequently have difficulty meeting aggressive cost, schedule, and technical objectives.

Today, new requirements for integration and interoperability, and the need to create systems of systems for network-centric warfare, are increasing the complexity of the software needed to achieve the DoD's mission. Acquisition program managers are challenged not only to grasp practical business concerns, but also to understand topics as diverse as risk, integration of commercial off-the-shelf (COTS) components, process capability, program management, source selection, evolutionary acquisition, and contract monitoring. The SEI has spent almost two decades compiling a body of research and developing practical solutions related to these topics. Unfortunately, mastery over this volume of information can be daunting for acquisition program managers attempting to benefit from the SEI's work.

Through the Acquisition Support Program, the SEI works directly with key acquisition programs to help them achieve their objectives. Teams of SEI technical experts work with programs in the Army, Navy, Air Force, non-service DoD, and civil agencies.

**Brian Gallagher**  
Director  
Acquisition Support

## ACQUISITION SUPPORT



*“When I joined the Standard Procurement System (SPS) as the new program manager, its future was in doubt; a jump start wasn’t going to do the job. Complete overhaul was in order. Thanks in part to SEI’s outstanding independent technical analysis, I’m proud to report that today SPS is meeting all cost, schedule, and performance goals, is the recipient of several industry technology awards, and is the cornerstone of the Department of Defense’s end-to-end procurement process.”*

**Army Colonel Jacob Haynes**  
Program Manager  
Standard Procurement System



### SEI Conducts Pilots of New Methods, Tools, and Technologies

During FY 2003, the SEI conducted several pilot projects that have given acquisition organizations access to SEI technologies and expertise while giving the SEI an opportunity to observe these technologies in real-world acquisition environments. These engagements contribute to a growing body of knowledge about best practices in the acquisition of software-intensive systems. SEI staff members help DoD organizations solve specific software engineering and acquisition problems. SEI direct support is funded through task orders for government work. Several of these pilots are described on pages 15–16.



### Piloting Standard CMMI Appraisal Method for Process Improvement (SCAMPI) in Acquisition Organizations

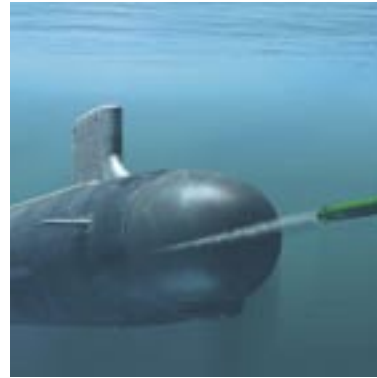
The purpose of this pilot was to ensure that CMMI SCAMPI<sup>SM</sup> method variants could be used efficiently and effectively in acquisition environments. CMMI SCAMPI incorporates the best ideas of several process improvement appraisal methods (e.g., Capability Maturity Model-Based Appraisal for Internal Process Improvement [CBA-IPI] and Software Capability Evaluation [SCE<sup>SM</sup>] methods) to baseline process capabilities based on CMMI models. SCAMPI Class A is a rigorous method that provides benchmark-quality ratings; SCAMPI Classes B and C are scaled-down versions that are less rigorous and do not produce ratings. Pilot participants, including the National Reconnaissance Office (NRO) and the Space and Missile Systems Center (SMC), tested Classes B and C to help identify program risks and set priorities.



### Piloting Options Analysis for Reengineering (OAR) with Future Combat Systems (FCS)

The SEI OAR<sup>SM</sup> method guides decisions about reusing software components within large and complex software systems. The method is used to identify assets that could be reused, evaluate the cost, effort, and risks associated with each reuse opportunity, and determine which assets to reuse.

The SEI helped the FCS Program adapt OAR for use by its lead systems integrator (LSI). The outcome of this pilot is a version of OAR adapted to help LSIs evaluate competing suppliers' estimates of feasibility, cost, risk, and schedule for mining legacy software and then decide whether to mine existing software assets or develop new ones.



### Piloting Software Product Line Acquisition with the Naval Undersea Warfare Center (NUWC)

*Software Product Line Acquisition: A Companion to A Framework for Software Product Line Practice* describes the technical and management areas in which organizations must be competent to successfully acquire and field a product line of software or software-intensive systems. The SEI conducted a pilot to apply the *Companion* within the NUWC. The NUWC has successfully launched a product line based on the RangeWare asset base, which is used for open-air ranges where the DoD conducts training, testing, and evaluation. This pilot helped determine whether specific product line practice areas in the *Companion* meet the needs of the NUWC and the general acquisition community. Other expected outcomes of this pilot are a *Companion* with mature guidelines for DoD acquisition and a case study that illustrates successful methods for putting product line approaches into practice in other DoD organizations.



### **SEI Helps Navy, Air Force on Common Link Integration Processing Program**

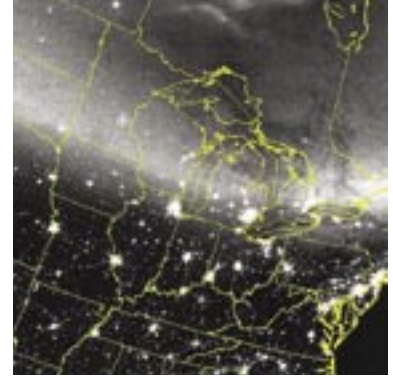
The SEI recently completed a Quality Attribute Workshop (QAW) for the Common Link Integration Program (CLIP), a collaboration between the U.S. Navy and Air Force. The CLIP Program will improve interoperability with the development of a common implementation of tactical data link (TDL) message processing and gateway capabilities that will reduce the life-cycle costs for the associated TDLs. The CLIP QAW resulted in the generation of scenarios that are stakeholder driven, prioritized, and refined, representing the quality attribute requirements for the middleware software solution for CLIP.



### **IRS First Civilian Federal Agency to Reach SA-CMM Level 2**

The Internal Revenue Service (IRS) announced on December 11, 2002 that it has become the first civilian federal agency evaluated by the SEI to reach Maturity Level 2 of the Software Acquisition Capability Maturity Model (SA-CMM). The IRS's Business Systems Modernization Office was rated at Maturity Level 2 of the SA-CMM for its Core Modernization projects.

The IRS is using the SEI model as a framework in its multiyear modernization program to help ensure that its systems are built right the first time, with less testing, increased quality, and reduced costs.



### **Space and Missile Systems Center Keeps Tabs on the State of Its Process**

Wrapping up Phase 1, a one-year effort at the Air Force Space and Missile Systems Center (SMC), an SEI-trained and -led team developed a state-of-the-process report for the SMC. The report uses data from nine SMC program-office appraisals based on the CMMI model adapted for acquisition. The results were characterized by a customer as "the most in-depth appraisal of acquisition practices used across the organization in the history of SMC."

*“We were all impressed with your team’s knowledge and immediate grasp of the issues that shaped the contract and its status. In my opinion, your team [validated] the relevance of the role of the SEI both in conducting assessments and in sponsoring the CMM models. Our experience is evidence that the work of the SEI is not isolated from the practical realities of work in the trenches and can provide positive, actionable feedback on complex software engineering projects.”*

an email from a contractor, sent to Blaise Durante,  
Deputy Assistant Secretary for Acquisition Integration,  
Office of the Assistant Secretary of the Air Force for Acquisition

### Independent Technical Assessments

Through independent technical assessments (ITAs), 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.

In a May 2003 ITA, the SEI assisted the Aerospace Corporation in a code audit of a command-and-control system’s software. The Aerospace/SEI team conducted an ITA on the program and found the quality of the developmental code to be poor. Based on the ITA results, the system program office decided to conduct an in-depth audit of the code. SEI personnel assisted in drafting the Code Review Log and reviewed portions of the code. Both the SEI and Aerospace found critical errors in the code, and the resulting report highlighted concrete actions to fix the problems.

### Future Combat Systems Program Supported

The SEI has continued to actively support the analysis of software within the Army’s Future Combat Systems (FCS) program, whose goal is a more efficient and effective Army. The SEI has significantly contributed to the FCS Software Development Plan, provided methods for evaluating the ability of FCS to reuse code from other systems, and specified software architecture description and evaluation methods for use on the program.

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.







### INTEGRATION OF SOFTWARE-INTENSIVE SYSTEMS (ISIS)

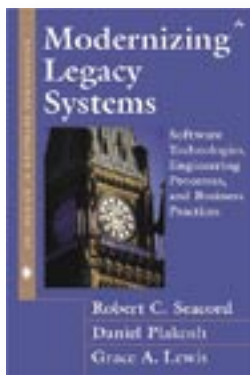
Few organizations build their software systems from scratch these days; instead they integrate predeveloped capabilities offered in products they purchase “off the shelf.” While this practice can reduce costs and development time, systems constructed from off-the-shelf (OTS) products, whether commercial or government issued, are often difficult and costly to integrate, support, and maintain. In past years, the SEI has sought to overcome the challenges of using, and misconceptions about, these products. The SEI has identified processes that acquirers and developers should follow to create, manage, and sustain systems constructed from commercial off-the-shelf (COTS) and government-issued products.

Organizations attempting to upgrade their systems also encounter challenges as they try to integrate new technologies and OTS products into existing systems. The SEI has provided guidance in successful modernization and integration strategies that help manage associated risk.

Based on these experiences, this year the SEI began a new initiative to investigate software integration and interoperability. How well software-intensive systems interoperate affects the capability of warfighters. Once achieved, interoperability must be sustained when upgrades are applied and capabilities enhanced. The SEI seeks to identify practices that assure sufficient sharing of information, make developers aware of how their systems interoperate with others, and make requirements for interoperability clear and available.

**Tricia Oberndorf**  
Director  
Dynamic Systems

*In one government program, CURE was performed first on the contractor and then on the government. The CURE results helped the government realize that the contractor didn't really understand what the government was trying to achieve. The government requested that CURE be performed on the replacement contractor.*



*Modernizing Legacy Systems* by Robert Seacord, Daniel Plakosh, and Grace Lewis describes engineering processes and business efforts that can be used in planning, justifying, and executing modernization.

### **SEI Transitions COTS Usage Risk Evaluation**

The SEI COTS Usage Risk Evaluation<sup>SM</sup> (CURE<sup>SM</sup>) method is a two-day assessment used to identify and mitigate risks at an early stage in the acquisition and development of COTS-based systems. It is performed through an extensive questionnaire and an on-site visit by an assessment team. The latest version, CURE 2002, was conducted at three organizations in FY 2003.

SEI CURE is aimed at both the government and the contractor side of a project. It is intended to assist key personnel on both sides in the decision making and skills that will be required when an acquisition is heavily oriented toward using commercial software.

While the evaluation is aimed at both the government and the contractor, it can be given individually to any organization that might participate in a COTS-related acquisition. It can also be used by contractors planning to bid on a forthcoming proposal.

### **Material Published in Four Reports**

In FY 2003, the SEI created materials for CURE that will allow the method to be administered by other organizations. To complement the evaluation questionnaire and analysis tools, the SEI developed

- a document that provides an overview and outline of the CURE process and details about the materials and mechanisms used
- a guide to direct an on-site discussion to expose risks to the program
- an evaluator's manual with a detailed description of each item in the CURE questionnaire
- a reference manual



### Team Recommends Improvements for Air Force

Several senior members of the SEI technical staff participated in independent technical assessments (ITAs) for the U.S. Air Force. After the team performed an assessment for one Air Force organization, the chief information officer requested expansion into another area. So a second team began work on that program, which provides mission-critical systems based on COTS products. The assessment team identified areas of potential improvement for the software system, software process, documentation, management, data, training, and metrics. The program accepted all of the team's recommendations. After the assessment, the SEI continued to support the organization in applying the recommendations. As a result of the ITA, the Air Force implemented a substantial reorganization, gained control over the test-and-release cycle, and began pursuit of a Maturity Level 2 SW-CMM rating.

### Research and Development Projects

Achieving information superiority through interoperability is a high-priority goal for future combat systems, logistics systems, and other government systems. The SEI conducted a research project that examined system-of-systems interoperability, which is essential to the future of network-centric warfare. Because no modern combat system stands alone, interoperation problems can limit the ability to perform operational missions. As part of its research, the SEI held a workshop with an advisory board of DoD experts.

The SEI team presented and received feedback on a model depicting the broad range of activities necessary to achieve interoperability and explored topics such as complexity, communication, funding, control, leadership, direction, and policy. The team gained insight into programs that are solving interoperability problems and the best approaches for conducting research on the current state of the practice.

Another SEI research team explored simulation or gaming techniques as a low-cost way for DoD acquisition managers to experience the typical risks of program management. The team created simulated scenarios to equip program managers with skills matched to complexities of modern acquisition; to improve the accuracy of program cost and schedule forecasts; and to increase the awareness of program managers and other key personnel of the dynamics that underlie typical acquisition problems.

*Critical DoD software systems must be highly dependable; that is, they must always meet critical user needs despite design or implementation errors and even in the face of unexpected inputs or direct attacks.*

### **PERFORMANCE-CRITICAL SYSTEMS (PCS)**

The development of large, networked software systems is complicated by inadequate notations and tools for specifying, modeling, and predicting performance, dependability, and interoperability. The SEI is creating, evaluating, and maturing technology to solve these engineering problems.

The purpose of SEI work in performance-critical systems is to help ensure that engineers specify and predict the performance, dependability, and interoperability of software-intensive systems when those systems are being designed. This will enable engineers to detect performance anomalies and potential system failures before integration test so that anomalies and failures rarely occur during use, even when the system is under a heavy load.





### High Dependability Computing Program to Help NASA

The NASA-sponsored High Dependability Computing Program is a consortium of university researchers led by Carnegie Mellon University. The SEI has participated in software dependability research as part of this consortium. This work has focused on the development and application of dependability cases, a method for developing structured arguments showing that NASA systems will meet NASA's needs for highly reliable software. The work has been focused on NASA's Mission Data System, which is scheduled for use on the Mars Scientific Lander in 2009.



### Architecture Analysis and Design Language Development

Work proceeded on a standard for the Architecture Analysis and Design Language (AADL). Standardizing this modeling language enables the development and predictable integration of real-time systems that can readily evolve. The standard supports early and repeated analyses of a system's architecture with respect to performance-critical properties such as schedulability, response time, and reliability.

The SEI is helping to create this standard under the auspices of the Society of Automotive Engineers Avionics System Division and with funding from the U.S. Army Aviation and Missile Command. The standard is based on more than 10 years of DoD-funded research and should be applicable in domains ranging from avionics to robotics and automotive systems. The SEI has contributed to tutorials, case studies, and handbooks that help users adopt this draft standard.









### SOFTWARE ARCHITECTURE TECHNOLOGY (SAT)

Through its work in software architecture, the SEI is helping acquirers and developers adopt effective practices based on proven software architecture techniques and methods. If function were all that mattered in software-intensive systems, any monolithic software would suffice; but other things do matter. Acquirers and developers 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 on choosing the correct software architecture—much more so than 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 methods and techniques for addressing key quality attributes and their relationships and tradeoffs at the software architecture level. For example, the SEI Quality Attribute Workshop (QAW) helps acquirers and developers identify and characterize the key quality attributes for a system. The SEI Architecture Tradeoff Analysis Method<sup>SM</sup> (ATAM<sup>SM</sup>) evaluation process enables software developers and acquirers to evaluate an architecture for required quality attributes and business goals before the system is actually developed. The SEI Attribute-Driven Design method helps developers choose architectural tactics. And the SEI's "views and beyond" documentation approach helps architects create relevant and useful documentation for software architectures. By using these practices, acquirers and developers exert greater control over key software qualities such as affordability, reliability, security, modifiability, and performance.

This body of work, which the SEI formerly called "Architecture Tradeoff Analysis," is now called "Software Architecture Technology" to indicate its broader focus.

**Linda M. Northrop**  
Director  
Product Line Systems



### **Software Architecture Curriculum Introduced**

In 2003, the SEI publicly offered a software architecture curriculum based on decades of experience with software-intensive systems and on four widely acclaimed books in the SEI Series in Software Engineering. This curriculum, made up of six courses and three certificate programs, helps equip software professionals with state-of-the-art practices for designing, documenting, evaluating, and implementing software architectures.

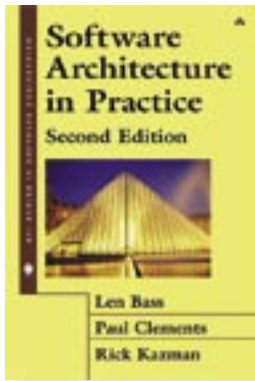
The U.S. Army has made this curriculum the basis for a new Army Software Architecture Initiative to be launched in 2004. The goals of that initiative are to increase software architecture capability in the Army through widespread training in software architecture principles and methods, and to institute software architecture evaluation in the Army's policy and infrastructure.

Dan Mazur of Key Bank said of one course in the curriculum, "I was evaluating this course to see if it would be a good fit for our department's architects. I'm recommending that all our architects take it."

### **SEI Makes Valuable Contribution to JNIC's Missile Defense System**

The Joint National Integration Center's (JNIC's) Missile Defense Wargame and Analysis Resource (MDWAR) system simulates a combat environment that commanders and their staff members can use to review missile and air defense doctrine, tactics, and procedures. In 2003, the JNIC asked the SEI to perform an ATAM evaluation on the MDWAR system's software architecture. That architecture represented the evolution of the Wargame 2000 system that the SEI evaluated in 2000. The uncovering of significant risks during the 2000 evaluation led to an improved MDWAR system. A survey of participants showed that they thought the evaluation had been valuable.

Since that initial ATAM evaluation, MDWAR has enjoyed success. New communities of stakeholders have embraced MDWAR, bringing with them new mission drivers. As a result, MDWAR must now grow from primarily supporting wargaming to also supporting missile defense system analysis, test, and integration. The request for a second ATAM evaluation to see how the MDWAR architecture stands up under these new mission drivers illustrated the JNIC's trust in the SEI and its software architecture methods and practices.



**New Book, *Software Architecture in Practice, Second Edition*, Published**

The second edition of *Software Architecture in Practice*, published this year in the SEI Series in Software Engineering, was written by SEI staff members to help practicing architects. This edition covers how a software system is structured and how its elements are meant to interact, as well as essential technical topics for designing, specifying, and validating the software architecture of a system. This book is an update to the first edition, which earned a Jolt Productivity Award from *Software Development*.

***Documenting Software Architectures: Views and Beyond* Wins Award**

*The SEI Series book Documenting Software Architectures: Views and Beyond* has been named a winner in the 13th annual Jolt Product Excellence and Productivity Awards. The book won a Productivity award in the Books, Practical/General Developer Interest category. Sponsored by Software Development, these awards recognize technical books that have “jolted” the industry, making the task of creating software faster, easier, and more efficient.

**Architecture Research to Provide Automated Support**

One goal of the SEI’s work in architecture design is to enable the predictable achievement of key quality attributes. For several years, the SEI has sought to understand in depth the quality attributes of modifiability and performance. During 2003, the SEI began to codify its knowledge into an architect design-assistant tool, or architecture expert, called ArchE.

The SEI plans to continue developing ArchE and, jointly with the Robert Bosch North America Research and Technology Center (RBNA RTC), to apply ArchE to a real problem. The goal of this collaboration with Bosch is to enable an architect using ArchE to produce a design for a new system that is equivalent or superior to the current design—as judged by

RBNA RTC domain specialists. The SEI hopes to demonstrate a crude version of ArchE that supports the design for this real system by July 2004. Once this proof of concept is complete, the SEI plans to expand the usability of ArchE and the number of attributes with which it can assist, and to collaborate with other organizations in piloting ArchE in specific development environments.

*“We, as a major power technology vendor, believe to be benefiting from these activities and are willing to contribute accordingly. The past collaboration with the SEI on the subject matter (PACC) gives us reason to expect excellent project results, not, at the last, because of the SEI’s strong focus on problems derived from and results that can be applied in industry.”*

**Otto Preiss**

Global Research Program Manager

Power T&D Applications

ABB

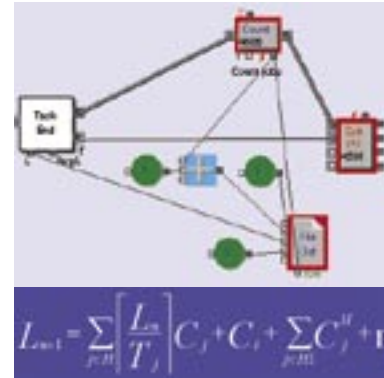
### **PREDICTABLE ASSEMBLY FROM CERTIFIABLE COMPONENTS (PACC)**

The use of pre-existing and commercially available software components to develop new systems can lead to significant economic and technical benefits. However, predictability is difficult to attain; 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.

SEI work in PACC focuses on the objectives of design predictability and component trust. A software development activity is predictable if the 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.

The SEI is developing seminal technology to certify software components for predictable assembly and to open up a new world of trusted software components.





**Starter Kit for Predictable Assembly Begun**

To transition PACC technology, the SEI has designed a starter kit. The PACC starter kit is a ready-to-use package comprising a foundation component technology and a set of quality-attribute-specific reasoning frameworks that can be used to predict the runtime behavior of assemblies (systems) of components. Several elements of this starter kit were developed in 2003.

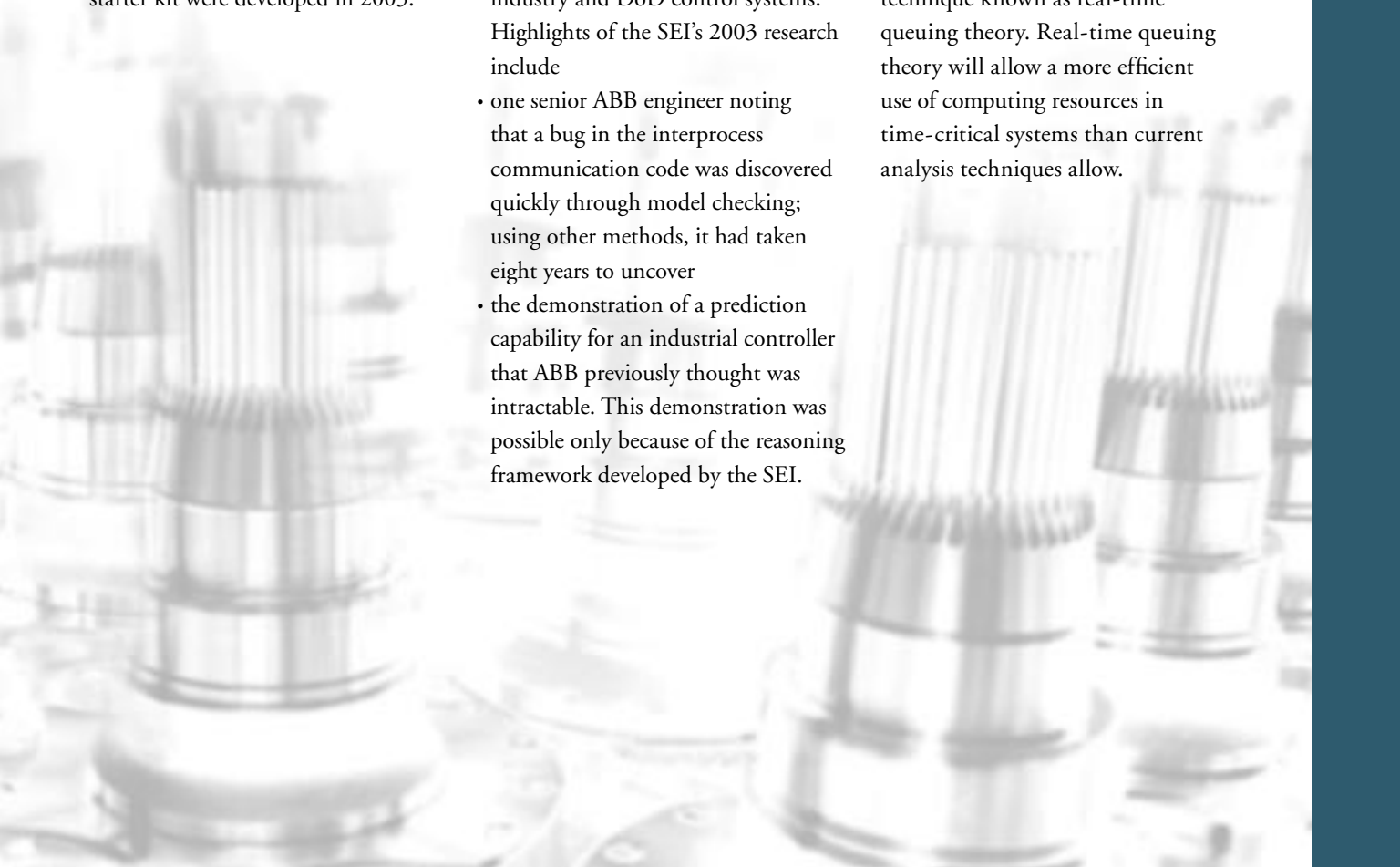
**SEI Completes Second Year of Collaboration with ABB Corporate Research**

In 2002, the SEI developed a proof of feasibility of PACC in the domain of power substation automation systems. In 2003, the SEI began working with a business unit of ABB Ltd. to demonstrate the feasibility of PACC in industrial robotics. The SEI developed reasoning frameworks for that application domain that can be generalized to a broad class of industry and DoD control systems. Highlights of the SEI's 2003 research include

- one senior ABB engineer noting that a bug in the interprocess communication code was discovered quickly through model checking; using other methods, it had taken eight years to uncover
- the demonstration of a prediction capability for an industrial controller that ABB previously thought was intractable. This demonstration was possible only because of the reasoning framework developed by the SEI.

**Frameworks for Reliability and Performance Reasoning Developed**

In 2003, the SEI developed frameworks for reliability and performance reasoning that incorporate state-of-the-art technology. The applicability of the performance-reasoning framework extends to a significant class of DoD and industrial real-time problems, providing a stepping stone to the use of a new analysis technique known as real-time queuing theory. Real-time queuing theory will allow a more efficient use of computing resources in time-critical systems than current analysis techniques allow.





*Based on practices codified in the SEI Framework for Software Product Line Practice and product line practice patterns, many companies have initiated product line efforts. Notable in 2003 are Agilent, Argon Engineering, John Deere, Microsoft, Raytheon, Siemens, and Austin Info Systems.*

*A software developer from John Deere reported in September 2003 that John Deere went from producing one software system in 10 years to producing two software systems in one year.*



### PRODUCT LINE PRACTICE (PLP)

Long a practice in traditional manufacturing, the concept of product lines is relatively new to the software industry. 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. A product line approach to software can reduce development cycles, improve return on software investments, and improve software system integration.

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
- 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 improve 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.

Organizations have turned to the SEI *Framework for Software Product Line Practice<sup>SM</sup>*, SEI product line methods and patterns, and the SEI book *Software Product Lines: Practices and Patterns* to launch and perfect their product line efforts. The SEI is helping organizations adopt a software product line approach by making product line development and acquisition a low-risk, high-return proposition.





### Bosch Product Line Effort Underway

After experiencing success with the SEI Capability Maturity Model for Software (SW-CMM) and CMM Integration (CMMI), Robert Bosch, the world's second leading supplier of automotive technology, decided to employ additional SEI practices—those for product lines. In 2003, Bosch announced a company-wide software product line initiative that uses SEI product line methods. The SEI helped Bosch develop a corporate product line adoption plan that includes use of the SEI Product Line Technical Probe<sup>SM</sup> evaluation process as well as product line practice patterns and adoption strategies. The company has now mandated that each of its business units initiate a product line over the next few years and anticipates that using SEI product line practice methods will enable it to maintain its competitive edge and high-quality products in a cost-effective way.

*“The SEI Framework for Software Product Line Practice is the engineering approach for software-intensive systems at Robert Bosch. We experienced substantial advantages in piloting the framework for embedded software, for example, one-third savings in memory resource consumption and slightly better timing behavior while providing the same features in core assets, and higher reuse potential than with the former reuse approach.”*

**Harald Hoenninger**

**Dr. Stefan Ferber**

Corporate Research and Development

Basic Research and Advanced Engineering Software-Intensive Systems

Robert Bosch GmbH

### SEI Helps Rearchitect FBCB2 into Software Product Line

The Army “after-action” reports following the recent wars in Iraq and Afghanistan underscored the results of an architecture study that the SEI performed on the Force XXI Battle Command Brigade and Below (FBCB2) system—the principal tactical digital command-and-control system for the U.S. Army. Although FBCB2 provides unprecedented capability to the warfighter, reduces Army casualties, and is changing the way battles will be fought, it needs to be rearchitected to completely deliver the promise it has demonstrated.

The system consists of rugged computer hardware running FBCB2 software, installed on a variety of weapons platforms and linked through a radio network. FBCB2 enables leaders to rapidly assess and control battle environments even under adverse conditions and answers three critical questions for soldiers in the field: (1) Where am I? (2) Where are my fellow soldiers? (3) Where is the enemy?

The SEI is working directly with the FBCB2 Program Office and its prime contractor (Northrop Grumman) to rearchitect FBCB2 as a software product line and correct flaws identified during the SEI's evaluation and FBCB2's recent operational use.

### Rockwell Collins Reports Product Line Benefits

In 1998, the U.S. Army Technology Applications Program Office (TAPO) engaged the SEI to support the development of a software product line for the Army's special operations helicopters. Over a several-year period, the SEI worked with TAPO to help realize its product line vision.

Rockwell Collins was eventually chosen as the contractor. Rockwell Collins reports that this vision has been realized; there is now an open systems architecture and common avionics software for the MH-47, MH-60, and MH/AH-6 helicopters. The Army plans to adopt the same software product line to meet the needs of the entire fleet of Army helicopters.

Rockwell Collins reports that the software product line supports easy insertion of new technology, enables multi-function displays and other avionic equipment units to be swapped from one helicopter avionics system to another with automatic reconfiguration, and accommodates integration of subsystems by third-party developers through well-defined application program interfaces.

# 5

ACQUISITION

ARCHITECTURE

ASP

ATAM

CERT/CC

CMMI

COTS

CREDENTIALS

CURE

ICCBSS

OCTAVE

PCS

PLTP

PRODUCT LINES

PSP

SCAMPI

SECURITY

SEI-EUROPE

SEIR

SEMA

SEPG

SOFTWARE

SPINS

SPLC

SYSTEMS INTEGRATION

SYSTEM OF SYSTEMS

TRANSITION

TSP

## SOFTWARE ENGINEERING PROCESS MANAGEMENT



### **CAPABILITY MATURITY MODEL INTEGRATION (CMMI)**

When organizations want to improve the way they do business, they often focus on securing the best people, methods, and tools. But it is processes that provide the means for directing those resources. Improving organizational processes has proven to be the most effective way to lower costs, improve quality, and deliver products and services on time. The SEI Capability Maturity Model® Integration (CMMI®) approach offers proven methods for improving processes. CMMI combines disciplines such as software and systems engineering and dovetails with other process-improvement methods that might be used elsewhere in an organization, such as ISO 9000 or Six Sigma.

CMMI consists of models, an appraisal method, and training courses. Users of CMMI models follow practices that successful organizations have found to be effective. Organizations that implement CMMI models can then undergo professional appraisals that help them document and track their progress. The CMMI training program ensures that users, appraisers, and instructors have the skills and knowledge required to meet CMMI standards.

Organizations using CMMI products and services are reporting benefits that contribute to their success:

- Overall development costs are lower, as are the costs of finding and fixing defects.
- Project schedules are more predictable, and scheduled tasks take less time to complete.
- Product and service quality increases; there are fewer defects at later stages of the development process.
- Customer satisfaction improves.

**Bill Peterson**

Director

Software Engineering Process Management

*"I have been involved with two different types of organizations on their process improvement... it is a great model for guiding process improvement for any organization, whether large or small. It is easy to interpret and to me is common sense."*

**Survey Participant**

*CMMI Interpretive Guidance Project: Preliminary Report*

**Survey Results Show User Satisfaction with CMMI**

Results from a survey administered to 668 respondents in summer 2003 indicate that organizations are pleased with the results of using CMMI. "[I] have not come across any framework as comprehensive and as detailed in guiding one to go about developing process improvement," one respondent wrote. Another wrote, "[CMMI is] invaluable for process improvement! The goals are realistic and the practices provide a clear picture of expectations. It provides guidance from an expert source and lends credibility to the decisions surrounding process changes."

**CMMI Adoption Is Proceeding Rapidly**

The 100th appraisal using a CMMI model and appraisal method was conducted this year. This means that more than 100 organizations have decided to adopt CMMI, established and staffed process-improvement programs, mapped their organizations' processes to CMMI best practices, spent resources to improve processes, and had an appraisal team evaluate their processes.

Publications about CMMI are available from various sources. Several books have been published, including a book comparing CMMI to ISO 9001:2000. The SEI published several reports, including interpretations of CMMI for COTS-based systems, operational organizations, service organizations, and earned-value management. Articles have been published in publications that include *CIO* and the *Dallas Morning News*.

**Air Force Memo Recommends CMMI**

A memorandum from Marvin R. Sambur, Assistant Secretary of the Air Force (Acquisition), asks program executive officers, designated acquisition commanders, and other managers to focus more attention on the application of systems engineering principles and practices throughout the system life cycle.

The memo, dated January 6, 2003, recommends CMMI as a tool that can be used to improve the acquisition process and provides a link to the CMMI model page on the SEI Web site.

925,000

*“I prefer the CMMI to the Capability Maturity Model for Software (SW-CMM) due to its flexibility, particularly in the measurement and analysis and project monitoring and control areas. The model appears to successfully target the areas of highest impact to an on-time, within budget, end delivery to the warfighter (e.g., good planning, defect analysis, replanning, risk).”*

**Survey Participant**

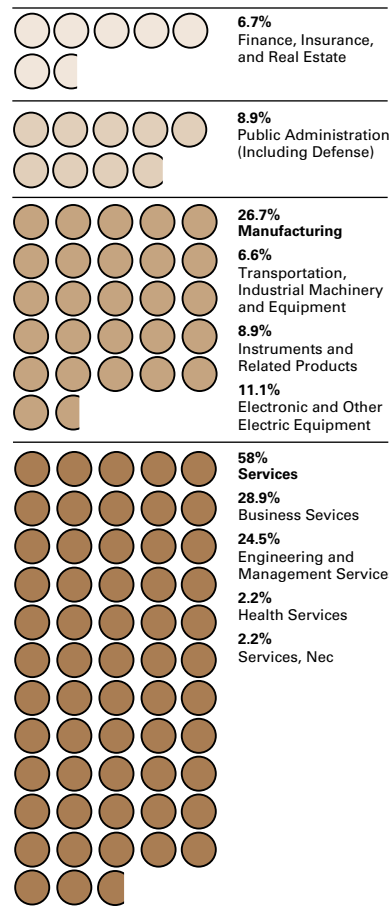
CMMI Interpretive Guidance Project: Preliminary Report

**More Organizations Are Becoming Interested in CMMI**

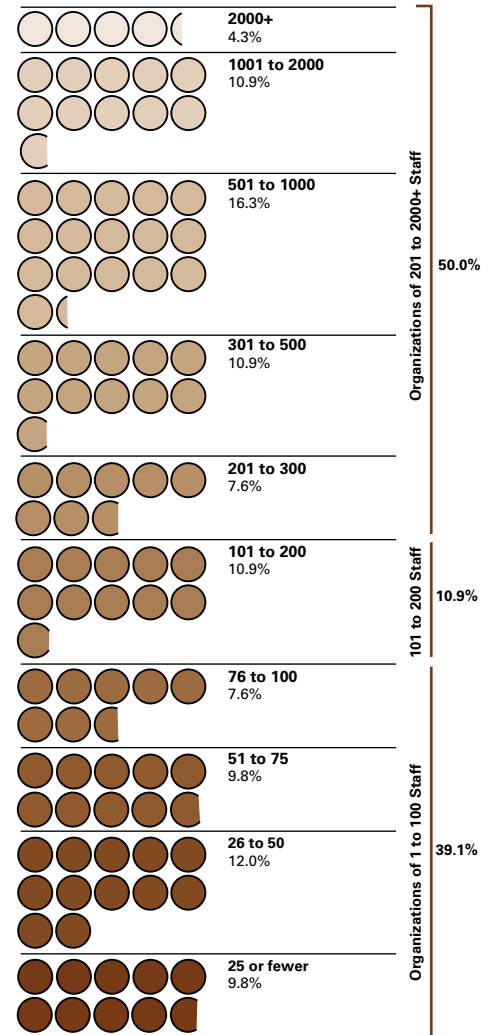
Visits to the CMMI Web site steadily increased throughout FY 2003, beginning with more than 750,000 in October 2002 and ending with more than 1 million in September 2003. The average number of visits per month to the Web site in 2003 was 925,103, up from 696,823 in 2002, an increase of more than 30 percent.

CMMI models are designed to fit the needs of small and large organizations from a variety of different industries. To date, organizations adopting CMMI have come from industries that include electronics, health services, finance, insurance, and transportation. Adopting organizations include Boeing, General Motors, JP Morgan, and Bosch.

**CMMI Adoption/Type of Organization**



**CMMI Adoption/Organization Size**



monthly Web visits

*SEMA techniques have helped many DoD and commercial organizations monitor and control software processes, better predict costs and schedules, and track organizational performance.*

### **SOFTWARE ENGINEERING MEASUREMENT AND ANALYSIS (SEMA)**

The purpose of SEI work in measurement and analysis is to help organizations develop successful measurement programs—programs that use data to inform decisions and are tied to an organization's business goals.

Recent reports show that nearly 80% of all software measurement programs fail within the first two years of operation. In most instances, failure results from organizational shortcomings—poor planning, lack of management buy-in, and excessive data-collection processes. The DoD and industry have benefited from the SEI's guidance in establishing structured measurement plans, practicing reliable data collection, and performing data analysis to improve projects, processes, and organizations.

Measurement and analysis techniques help organizations track their efforts to improve software processes, lower costs, reduce defects, stay on schedule, and gather valuable return-on-investment information. From introducing basic measurement principles to helping high-maturity organizations master advanced analytical methods, the SEI provides the guidance necessary to produce meaningful cost savings.





### **Acquisition Survey Helps Army Establish Improvement Baseline**

The SEI is helping the U.S. Army Strategic Software Improvement Program (ASSIP) to identify effective practices and risks associated with its acquisition of software-intensive systems. During FY 2003, the SEI developed and administered a survey to 150 Army acquisition program managers to help the ASSIP evaluate its acquisition environment. The survey and documented analysis will help ASSIP to create a baseline, in conjunction with other efforts, for improvements over the next several years.

### **Measurement Techniques Help Accelerate Software Process Improvement**

The SEI is developing measurement and analysis approaches to help accelerate organizations' efforts to improve their software processes. During FY 2003, two of these approaches—the goal-question-indicator-metric (GQIM) technique and Six Sigma for Software—were applied at Warner Robins Air Logistics Center and Accenture's U.S. Government Operating Unit. GQIM and Six Sigma for Software will help those organizations with the quantitative project-management requirements for achieving CMMI Maturity Level 4, the second-highest level that can be achieved.

SEI experience has shown that using these techniques in combination helps organizations to create visual displays, called indicators, to expertly plan and track their measurement programs. During FY 2003, these techniques were also successfully applied at the U.S. Air Force Human Resource Command & Control Systems Program Office for its internal engineering processes and to help it become a software-acquisition organization.

GQIM is a 10-step process that helps organizations to identify and define software measures that directly support their business, process-improvement, and project goals. Six Sigma supports this process by providing a toolkit of methods for improving product and process quality.

*“Accenture has been working with the SEI...to refine our approach for performing quantitative analysis. Their practical experience with quantitative analysis has helped focus our efforts and improve our skills with creating process performance baselines and predictive models. [The SEI] is able to explain statistical process control concepts for software and system development processes in ways that are understandable, acceptable, and useable.”*

**Sarah Bengzon**  
Director of Quality

Accenture Global Government  
Operating Group

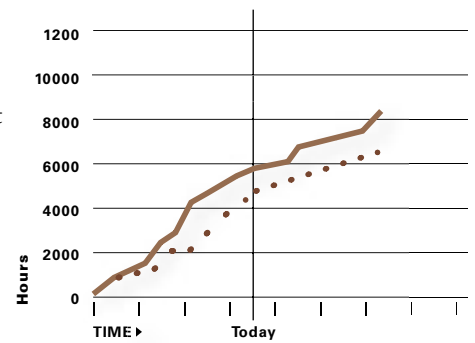
**Nathan Shirley**  
Special Projects Lead

Accenture Quality and  
Process Improvement Program

### Diagramming Technique Improves Project Manager Insight

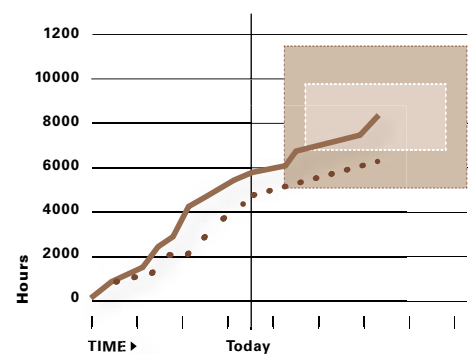
The SEI has developed a diagramming technique that is helping project managers gain greater insight into measurement data and make more informed business decisions. The technique involves translating traditional control charts, used to show the distribution of software process statistics over time, into enhanced earned-value charts that provide a clearer, more intuitive view of cost and schedule data for project managers. These comprehensive charts are helping organizations such as Accenture’s U.S. Government Operating Unit to take a closer look at their measures and processes and make better data-driven decisions.

#### Before Control Ranges



When monitoring project progress, project managers often use current effort vs. schedule data to estimate how long a project will take and how much it will cost.

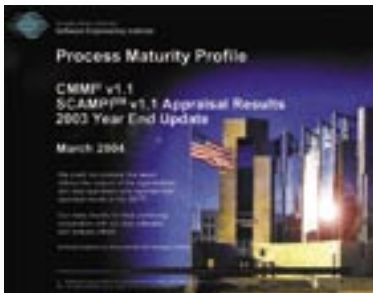
#### With Control Ranges



By adding ranges based on customer needs and control limits, project managers have a “measuring stick” for making on-the-spot decisions about reacting to cost and schedule deviation.



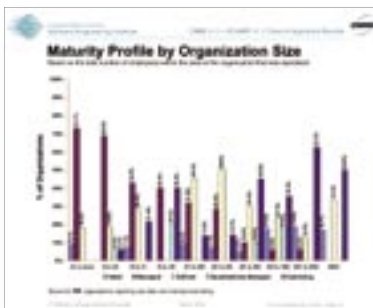
### SEIR Disseminates Latest Adoption Trends



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, [seir.sei.cmu.edu](http://seir.sei.cmu.edu)). Software professionals can support their acquisition and development efforts by using this resource to find detailed information on a variety of software technologies.



By the end of FY 2003, the SEIR had more than 25,000 registered users.



One component of the SEIR is the Process Appraisal Information System (PAIS). The PAIS provides the findings and data to support the publication of Process Maturity Profiles ([www.sei.cmu.edu/sema/profile.html](http://www.sei.cmu.edu/sema/profile.html)). During FY 2003, the SEI published the first maturity profile for Capability Maturity Model Integration (CMMI) models, which shows the latest CMMI adoption trends worldwide. Appraisal data and organizational information are presented in a series of graphs and bar charts by organization type, size, location, maturity level, and other variables. These findings can be used by DoD and industry organizations for comparing process strengths and weaknesses, predicting performance, and establishing benchmarks.

*The TSP applies to all aspects of software development: requirements elicitation and definition, design, implementation, test, and maintenance.*

*The TSP can support multidisciplinary teams that range in size from 2 engineers to more than 100 engineers. It can be used to develop various kinds of products, ranging from real-time embedded control systems to commercial desktop client-server applications.*

#### System Test Defects

(per thousand lines of code)

0.40 TSP projects average

15.00 Typical projects average

#### Delivered Defects

(per thousand lines of code)

0.06 TSP projects average

7.50 Typical projects average

#### Percent of System Test Effort

4% TSP projects average

40% Typical projects average

#### TEAM SOFTWARE PROCESS (TSP)

Software projects are often late, over budget, of poor quality, and difficult to track. Engineers often have unrealistic schedules dictated to them and are uninformed about business objectives and customer needs. They are required to use imposed processes, tools, and standards and often take shortcuts to meet schedule pressures. Few teams can consistently be successful in this environment.

The SEI is leading the way in helping software organizations solve these persistent problems, and the SEI Personal Software Process<sup>SM</sup> (PSP<sup>SM</sup>) and Team Software Process<sup>SM</sup> (TSP<sup>SM</sup>) methodologies are key parts of the solution. The SEI PSP enables software engineers to plan their work based on personal data, to measure their work and use their results to continually improve, and to feel personally responsible for the quality of the products they produce. The SEI TSP enables managers to institute a team environment that supports PSP work and to build and maintain self-directed teams whose members understand business and product goals and who produce their own plans to achieve those goals. The PSP and TSP are powerful tools that foster the necessary skills, discipline, and commitment required for successful software projects.

*A summary of data from 20 TSP projects in 13 organizations shows that teams using the TSP improved their productivity by an average of 78% while producing products that had 10 to 100 times fewer defects than typical software products.*

*The Team Software Process in Practice: A Summary of Recent Results*

#### Microsoft Process Yields

(% Defects Removed Before Phases)

69% Before compile

89% Before unit test

97% Before build and integration test

99% Before system test

#### Microsoft Completes Successful TSP Project

A team at Microsoft recently completed its first TSP project. The eight-member team delivered the seven-month project within one week of the team's initial schedule estimate. The quality of the software developed by this team was high: only 11 defects were found in system and integration test. Out of a total of more than 2,300 task hours spent on the project, the team spent fewer than 10 task hours fixing the 11 defects found in test.

The team members enjoyed working on the TSP project. Here are some typical comments from team members:

"Tracking data (size, effort, quality) helps with taking appropriate corrective or preventive actions."

"I feel that buy-in into the process and positive support from the management was a key factor in the team's focus on following the process."

"High quality is achievable."

Additionally, Carol Grojean, Microsoft program manager, stated, "I would not run a project any other way."

#### TSP in Practice Shows TSP Effectiveness

An SEI report published in September 2003, *The Team Software Process (TSP) in Practice: A Summary of Recent Results*, summarized results of more than 20 TSP projects at 13 organizations. The average schedule deviation for these projects was 6 percent. TSP teams delivered software with an average of 0.06 defects per thousand lines of code, compared to 7.5 in typical projects. And as a result of reduced time spent in test because of higher quality products being delivered into test, the TSP teams experienced an average 78% increase in productivity.

These companies contributed the data summarized in *TSP in Practice*: ABB, Inc.

Advanced Information Services  
Bechtel

Cognizant Technology Solutions  
EBS Dealing Resources, Inc.

Hill Air Force Base  
Honeywell

Microsoft Corporation  
Naval Air Warfare Center

Quarksoft, S.C.

SDRC

United Defense, L.P.

Xerox

*“We had to change what we do to develop software. We had to change how we think about developing software. TSP is a tool—the team made it work!”*

**Dave Curry**  
AV-8B software engineer  
and TSP process manager

#### **TSP Helps NAVAIR Team Achieve SW-CMM Level 4 at Accelerated Pace**

The AV-8B Joint System Support Activity (JSSA) is a Naval Air Systems Command (NAVAIR) team that provides software support for the AV-8B Harrier aircraft for the U.S. Marine Corps, integrating new capabilities into the aircraft. This complex integration takes an intensive software effort.


“Our mission is to help defend this nation,” says Dwayne Heinsma, present AV-8B JSSA lead, in a NAVAIR press release. “We do that by putting increased warfighting capability in the hands of our Marines. Higher quality software leads to less rework, which results in a shorter turnaround time for the product, which means the product gets to the Fleet faster and within budget. It’s a win-win-win proposition.”

An organization that is committed to continuous improvement, the AV-8B JSSA began a CMM-based improvement effort in March 2000. In October of the same year, the organization began introducing the TSP and launched its first TSP team in January 2001.

With the help of the TSP, the organization was able to reach Capability Maturity Model for Software Level 2 more than 40% faster than average. With continued use of the PSP/TSP, the organization was able to progress from its Maturity Level 2 assessment to a Maturity Level 4 assessment in only 16 months. Similar benefits are expected using the TSP with CMM Integration (CMMI).

# 10 to 100





Engineers who used the TSP at AV-8B JSSA were enthusiastic about the method. In the words of the software team lead, “It is the future; I am sold on it.”

Jeff Schwalb, PSP instructor and TSP launch coach, said that describing process-improvement progress as “quick” or “slow” is relative. “What I want people to understand is the ‘quickness’ TSP offers relative to the traditional ‘one-step-at-a-time’ approach to process improvement. In a nutshell, TSP gives you a defined and documented process that you can use right away and then refine as you go.”

### TSP-Secure

Most software security vulnerabilities result from defects that are unintentionally introduced in the software during design and development. Therefore, to significantly reduce software vulnerabilities, the overall defect content of software must be reduced. Today’s common software engineering practices lead to a large number of defects in released software. However, data from dozens of software projects that have systematically applied improved software development practices such as the TSP show 10 to 100 times fewer defects in released software. Applying these improved practices should lead to a similar reduction in the defects that lead to vulnerabilities. Furthermore, by focusing on the specific types of defects that lead to vulnerabilities, an even greater reduction in vulnerabilities could be achieved.

TSP for Secure Software (TSP-Secure) is based on proven TSP practices and the CERT Coordination Center’s extensive security skills and knowledge. The goal of the SEI TSP-Secure project is to develop a TSP-based method that can predictably produce secure software.

Specifically, TSP-Secure augments the TSP with

- specialized security training
- secure design, implementation, and testing practices
- vulnerability removal filters at multiple points in the software development life cycle
- security-related predictive measures

An initial pilot project of TSP-Secure showed promising results. The pilot delivered a product in which no security defects were found during system and integration test, and no security defects have been found after several months of use.

# times fewer defects



ACQUISITION

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ICCBSS

OCTAVE

PCS

PLTP

PRODUCT LINES

PSP

SCAMPI

SECURITY

SEI-EUROPE

SEIR

SEMA

SEPG

SOFTWARE

SPINS

SPLC

SYSTEMS INTEGRATION

SYSTEMS OF SYSTEMS

TRANSITION

TSP

# NETWORKED SYSTEMS SURVIVABILITY



The continued growth of the Internet (233 million computers in January 2004<sup>1</sup>) has spawned a global information society. Along with increased reliance on the Internet comes increased risk that information can be compromised by attacks from intruders. The tools used for attacks are becoming both increasingly destructive and increasingly easy for novice intruders to use. Moreover, reports of vulnerabilities in widely used commercial software—vulnerabilities that intruders exploit to compromise systems—continue to increase. In this environment, organizations are challenged to ensure that their networked computing systems are survivable—that they provide essential services in the presence of attacks and failures and that they recover full services in a timely manner.

Through its work in survivable systems, the SEI seeks to ensure that management practices and technology are available to help organizations recognize, resist, and recover from attacks on networked systems.

**Richard D. Pethia**  
Director  
Networked Systems Survivability

<sup>1</sup>[www.isc.org/ops/ds](http://www.isc.org/ops/ds)

*“Just a note to thank you for your excellent advisories. I can’t tell you how many times you’ve saved my bacon. Your advisories are extremely timely, and precede those sent by my other security sources by a great margin. I run five Microsoft servers for a small company, and it’s essential that we have 99.9% uptime. As soon as I receive your advisories, I immediately schedule an extra server update. Through your efforts, I have been able to maintain 100% uptime this deadly summer.”*

**Marina Browne**  
Ifop-Canada Market Research



### CERT COORDINATION CENTER

Established in 1988 as the first computer security incident response team (CSIRT), the CERT® Coordination Center (CERT®/CC) celebrated its 15th anniversary this year. Staff members provide technical advice 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. To enhance their ability to identify solutions, CERT/CC experts analyze malicious code used by attackers.

The CERT/CC alerts Internet users to potential threats to the security of their systems and provides information about how to avoid, minimize, or recover from damage. Staff members have responded to 320,000 security incidents that have affected hundreds of thousands of Internet sites, have worked on 13,000 reported vulnerabilities, and have issued hundreds of advisories and bulletins, which are disseminated widely.

# 320,000

**CERT ANALYSIS CENTER**

The CERT Analysis Center (CERT/AC), established three years ago, extends the work of the CERT/CC by analyzing the threat environment from a number of perspectives, including political, economic, social, and technical. Staff members are developing methods to assess and predict Internet threats. Their work includes techniques to identify unauthorized and potentially malicious activity within overall network/system usage. They have been successful in isolating significant data that typically cannot be distinguished from the “noise” of system usage.

The CERT/AC staff has provided guidelines to help the U.S. Secret Service incorporate computer-related considerations into both investigations and preparations for protective activities such as those designated by Congress as national special security events (NSSEs); for example, the Republican and Democratic national conventions are NSSEs. The guidelines focus on the intersection of the physical world and the world of networked computers.

# security incidents

*The mission of the CERT Research team is to identify and eliminate shortcomings in security and survivability engineering methods. Gaps in engineering capabilities represent high-leverage opportunities where solutions can transform the state of practice and lead to more secure and survivable systems.*

*CERT Research 2003 Annual Report*



The first *CERT Research Annual Report* was published in 2003.

## RESEARCH AND DEVELOPMENT

As the Internet and networked systems become more widespread and advanced, there is a higher risk of accidents, attacks, and failures. One of the goals of SEI research in survivability is to try to find ways to improve technical approaches for identifying and preventing security flaws, for limiting the damage from attacks, and for ensuring that systems continue to provide essential services in spite of compromises or failures.

SEI researchers are working on tools and techniques that reduce risk early in the software life cycle by preventing security flaws. Work in FY 2003 focused on modeling and simulation and on taking an engineering approach to developing survivable systems.

The SEI has also developed a set of risk-management methodologies and a set of well-defined survivability and security practices. These include the Operationally Critical Threat, Asset, and Vulnerability Evaluation<sup>SM</sup> (OCTAVE<sup>®</sup>) methodology and Electronic Authentication Risk and Requirements Analysis (e-RA), as well as an extensive collection of best security practices.



*The state of Florida has become the first state to launch a widescale computer security incident response team (CSIRT) program. The SEI provided CSIRT training to facilitate the launch, and Florida is now discussing certification with the SEI.*

*“The creation of computer security incident response teams within each of our state agencies is a key step to ensuring the safety and security of the cyber infrastructure within state government. I am proud to report that Florida is the first state in the nation to create these teams enterprise wide.”*

**Governor Jeb Bush**



## TRAINING AND EDUCATION

The SEI offers public training courses for technical staff and managers of CSIRTs as well as for system administrators and other technical personnel interested in learning more about network security. Staff members also conduct analyses of training needs in information security, and they define and develop curricula. These combined activities help fill the gap between the number of security experts needed and the number available.

The SEI offers 11 information security courses. Four of the courses provide introductory and advanced training for technical staff and managers of CSIRTs and satisfy the core training requirements for the CERT-Certified Computer Security Incident Handler program. These courses are Creating a Computer Security Incident Response Team, Managing Computer Security Incident Response Teams, Fundamentals of Incident Handling, and Advanced Incident Handling for Technical Staff.

The SEI offers three courses on broad Internet security. Information Security for Technical Staff is an intensive five-day course for technical staff. New courses include the follow-up course Advanced Information Security for Technical Staff and Information Security for Network Managers, which is designed for IT and network managers.

The SEI provides two courses in the OCTAVE methodology. The OCTAVE Training Workshop helps individuals and analysis teams independently direct and manage security evaluations for their organizations.

OCTAVE Instructor Training is designed for organizations that license the OCTAVE methodology. Additionally, the SEI offers two courses exclusively at customer sites. Concepts and Trends in Information Security is a one-day overview of security issues, techniques, and trends. Information Survivability: A New Executive Perspective is geared toward executives who would like more knowledge of information survivability and security.



### US-CERT

In September 2003, the U.S. Department of Homeland Security announced the creation of the United States-Computer Emergency Readiness Team (US-CERT), a joint effort with the CERT/CC. The goal of US-CERT is to reduce the frequency and severity of cyber attacks by building a joint effort among CSIRTs, information sharing and analysis centers (ISACs), managed security service providers (MSSPs), technology vendors, security product and service providers, and other organizations that participate in watch, warning, and response functions.



### OCTAVE-S

The SEI released OCTAVE-S, a variation of the Operationally Critical Threat, Asset, and Vulnerability Evaluation (OCTAVE) methodology that meets the needs of small businesses. Like the original OCTAVE method, OCTAVE-S is a risk-based information security assessment that an organization can perform using a team of its own personnel. OCTAVE-S uses a streamlined process adapted to the more limited means and unique constraints of small organizations. In August 2003, the SEI published the *OCTAVE-S Implementation Guide* and made OCTAVE-S freely available for download from the Web. Interest is so high that OCTAVE-S was downloaded 68 times in the first day—even before a formal announcement was made. As of December 2003, it had been downloaded by more than 2,800 people from 80 countries. Similarly, 2,600 people have downloaded the OCTAVE method since it became freely available in June 2003.



### Methodologies and Training for the U.S. Secret Service

The CERT Analysis Center staff has developed a methodology for assessing cyber-security threats to United States Secret Service (USSS) protective missions through detailed analysis of the systems that affect or may relate to those missions. The staff regularly provides training in this methodology to Secret Service agents. In addition, the SEI performed a training needs assessment for the Electronic Crime Special Agent Program (ECSAP) and provided training to ECSAP agents to help them stay abreast of changes in technology and stay ahead of the ever-increasing use of technology in criminal enterprises. Through training and a pilot activity, the SEI is currently introducing the USSS to OCTAVE-S. OCTAVE-S has been selected by the USSS as an assessment methodology that will enable individual organizations to raise awareness and improve their information security after on-site USSS Electronic Crime Task Force activities or investigations have been completed. These activities are part of the USSS Critical Systems Protection Initiative.



### Professional Certification for Incident Handlers

The SEI has created a program to certify individuals in computer security incident handling. To be a CERT-Certified Computer Security Incident Handler, an individual must meet training and experience requirements and pass an examination. Certified professionals have a common vocabulary, understanding, and set of essential skills. They are qualified to create, manage, and provide computer security incident-handling services for a defined constituency and to cooperate with one another on responses to incidents that span constituencies when necessary. The new certification program complements the SEI's existing incident-handling training curriculum and helps reduce the shortage of well-qualified incident-handling professionals.



### Large-Scale Analysis Tools for Network Security

The CERT Analysis Center staff developed a set of software tools for analyzing large-scale, fluid data sets nearly in real time. The operational use of these tools has resulted in a major advance in the survivability of critical networks. The data collected through these tools has enabled the staff to identify large-scale security vulnerabilities, including unauthorized network use, access to networks from external sources, and patterns of potentially malicious scanning. A benefit of the software is the ability to capture previously undetectable scans of the network. In initial testing, patterns of coordinated, small packet scans were identified as coming from specific countries with the probable intention of mapping the network and identifying vulnerabilities. In another instance, unexpected and previously undetected Internet traffic was identified moving through a network. As a result, corrective action was taken and overall security was improved.



### Insider Threat Study

Insiders—present and past employees and contractors—account for at least one-third of computer security breaches. The SEI's CERT Analysis Center is working with the United States Secret Service National Threat Assessment Center to develop a comprehensive methodology for detecting, preventing, and investigating insider threats to computer security. A goal is to meet the needs of critical infrastructure providers and to provide early identification of insiders who might pose a security threat. Phase I of the Insider Threat Study is complete, with the creation of an online survey of insider threats in critical infrastructures and the creation of two codebooks. The Analysis Center staff will use these books to code selected insider threat cases. This activity will result in data that the Analysis Center staff and the USSS can use to develop insider threat profiles and predictions.



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SEI-EUROPE

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SEMA

SEPG

SOFTWARE

SPINS

SPLC

SYSTEMS INTEGRATION

SYSTEM OF SYSTEMS

TRANSITION

TSP

# LEADERSHIP AND OVERSIGHT

### SEI DIRECTOR'S OFFICE

The SEI Director's Office ensures the smooth, efficient operation of the SEI. Acting Director Angel Jordan and Chief Operating Officer Clyde Chittister build strong, collaborative relationships with leaders in government, industry, and academia, communicating the SEI's vision for software engineering.



**Angel Jordan**  
Acting Director

**Clyde Chittister**  
Chief Operating Officer



**Bill Peterson**  
 Director, Software  
 Engineering Process  
 Management



**Sally Cunningham**  
 Director, Technology  
 Transition Services



**Steve Huth**  
 Manager, Information  
 Technology



**Tom Brandt**  
 Director, Program  
 Integration



**Tricia Oberndorf**  
 Director, Dynamic  
 Systems





### SEI MANAGEMENT TEAM

The SEI management team leads the SEI by setting and executing SEI strategies, goals, and priorities and demonstrating the SEI core values of impact, excellence, and integrity.



**Brian Gallagher**  
Director, Acquisition  
Support



**Linda Northrop**  
Director, Product Line  
Systems



**Richard Pethia**  
Director, Networked  
Systems Survivability



**Jill Diskin**  
Manager, Human  
Resources



**Peter Menniti**  
Manager, Financial  
and Business Services

## 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.



**Barry Boehm**  
TRW Professor of Software Engineering, University of Southern California  
Director, University of Southern California Center for Software Engineering



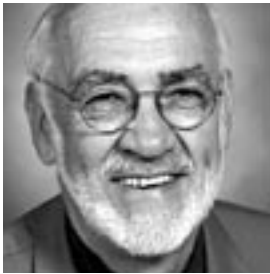
**William Bowes**  
Vice President, Program Management, Litton Industries



**Thomas Brandt**  
Director, Program Integration, Software Engineering Institute



**Christine Davis**  
Chair, Board of Visitors  
Consultant  
Former Executive Vice President, Raytheon Systems Company



**Gilbert Decker**  
Consultant  
Former Executive Vice President of Engineering and Production, Walt Disney Imagineering



**Philip Dowd**  
Senior Vice President, SunGard Data Systems  
Trustee, Carnegie Mellon University



**Dave McCurdy**  
President, Electronic Industries Alliance



**Alan McLaughlin**  
Consultant



**Michael K. Reiter**  
Professor of Electrical and Computer Engineering and Computer Science, Carnegie Mellon University



**Donald Stitzenberg**  
Vice President, Global Supply Chain, Meril  
Trustee, Carnegie Mellon University

## 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**

Deputy Under Secretary of Defense (Science & Technology)

**Mr. Mark Schaeffer**

Principal Deputy, Defense Systems

**Mr. Bob Nemetz**

Principal Deputy, Acquisition Resources and Analysis

**Dr. Mike McGrath**

Deputy Assistant Secretary of the Navy for Research, Development, Test and Evaluation

**Mr. Blaise Durante**

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

**Mr. Jim Engle**

Deputy Assistant Secretary of the Air Force for Science, Technology and Engineering

**Mr. John Landon**

Deputy Assistant Secretary of Networks and Information Integration

**Dr. Thomas Killion**

Acting Deputy Assistant Secretary of the Army (Research and Technology)

**Dr. Angel Jordan**

Acting Director, Software Engineering Institute

**Col Nick Justice**

Acting Assistant Deputy for Systems Management and Acquisition, Army

**Mr. Robert M. Wright**

Chief, Information Management Missile Defense Agency





## EDUCATION & TRAINING/CERTIFICATES & CERTIFICATIONS

### SEI Courses

SEI courses help bring technologies and practices from the research lab into widespread use. The courses listed on pages 60–61 were delivered during FY 2003 at the SEI's facilities in Pittsburgh, PA and Arlington, VA and at sites in Boston, MA; St. Louis, MO; St. Petersburg, FL; New York, NY; Paris, France; London, England; Frankfurt, Germany; and Amsterdam, The Netherlands.

### SEI Credentials Program

Since 1984 the SEI has been identifying, developing, and advocating practices for designing high-quality software and protecting networked systems. To help organizations put these practices in place, the SEI has developed a new series of credentials programs. Each program guides participants through a series of courses chosen to help them develop expertise in a specific area of work.

The SEI offers both certificate and certification programs. *Certificates* are awarded after participants attend a specified series of courses and serve to recognize successful completion of an educational process. Certificate programs are a good way to build skills and generally do not require testing or follow-up training. *Certification* is earned after completion of a specified series of courses and assessment against a set of industry-relevant standards. Certification often includes ongoing requirements that must be met to keep the certification valid. While SEI certifications do not grant permission to use the intellectual property of the SEI, they do signify that the student has been certified by the SEI to have obtained a specific set of skills and knowledge in a particular area. Certification allows participants to build their credentials through an objective confirmation of their skills.

# 2,360

**Course Attendees**  
by category of organization

5% University and  
other research  
organizations

10% Federal  
government

2% State and local  
government

1% Foreign  
government

10% Department  
of Defense

72% Business and  
industry



# total attending

## COURSES

The number of offerings for each course is indicated to the left of the title.

### Organizational Management

- 3 Consulting Skills Workshop
- 1 Managing Technological Change

### Capability Maturity Model Integration (CMMI)

- 18 Intermediate Concepts of CMMI
- 5 Introduction to CMMI, Continuous Representation
- 12 Introduction to CMMI, Staged Representation
- 7 SCAMPI Lead Appraiser Training
- 11 CMMI Instructor Training

### Capability Maturity Models

- 8 Introduction to the Software CMM
- 4 Introduction to the People CMM
- 4 Introduction to the Software Acquisition CMM

### COTS-Based Systems

- 2 COTS-Based Systems for Program Managers

### Software Architecture

- 2 ATAM Evaluator Training
- 5 Software Architecture: Principles and Practices
- 1 Software Architecture Design and Analysis
- 2 Documenting Software Architectures

### Software Process Improvement

- 2 CBA Lead Assessor Training
- 3 Continuous Risk Management
- 2 Defining Software Processes
- 2 High Maturity with Statistics
- 1 Implementing Goal-Driven Software Measurement
- 1 Introduction to Personal Process
- 3 Managing Software Projects with Metrics
- 3 Mastering Process Improvement
- 2 PSP for Engineers I: Planning
- 2 PSP for Engineers II: Quality
- 2 PSP Instructor Training
- 2 SCE Lead Evaluator Training
- 2 Statistical Process Control for Software
- 2 TSP Launch Coach Training
- 1 Managing TSP Teams
- 1 TSP Executive Strategy Seminar

### Computer and Network Security

- 2 Advanced Incident Handling for Technical Staff
- 4 Creating a Computer Security Incident Response Team
- 2 Fundamentals of Incident Handling
- 6 Information Security for Technical Staff
- 4 Managing Computer Security Incident Response Teams
- 6 OCTAVE Training Workshop
- 2 OCTAVE Instructor Training
- 3 Concepts and Trends in Information Security
- 2 Information Survivability: A New Executive Perspective

## SEI CREDENTIALS PROGRAM

Currently, the SEI offers seven certificate programs and one certification program:

### Software Engineering Process Management

SEI Certificate in Software Engineering Process Management

SEI Certificate in Software Process Improvement Implementation

SEI Certificate in CMMI

SEI Certificate in Personal Software Process for CMMI

### Software Architecture

Software Architecture Professional Certificate

ATAM Evaluator Certificate

ATAM Lead Evaluator Certificate

### Computer Security

CERT-Certified Computer Security Incident Handler Certification



**Geir Fagerhus**  
Managing Director  
SEI-Europe

### SEI-EUROPE

In January 2003, the SEI opened its doors to European software engineers by establishing an office in Frankfurt, Germany. With the support of its European founding partners as well as the main SEI office in Pittsburgh, SEI-Europe carries out the SEI's mission to help others improve the way they develop software by offering public courses, colloquia, workshops, industry memberships, and opportunities for joint research projects to European software engineers.

The annual European Software Engineering Process Group (E-SEPG) Conference has been popular with European software engineers since 1996, and many European organizations use SEI-developed methodologies such as the Capability Maturity Model for Software (SW-CMM), Personal Software Process (PSP), and Team Software Process (TSP). By bringing SEI expertise to Europe, the SEI's Frankfurt office supports the many European automotive, telecommunications, and financial organizations that already use SEI methodologies, as well as European organizations just beginning to adopt them. SEI-Europe will offer its first courses in Capability Maturity Model Integration (CMMI), Standard CMMI Assessment Method for Process Improvement (SCAMPI), and information security in 2004.

*The vision of the SEI Independent Research and Development (IR&D) program is that over the next 10 years at least four new and improved practices, initially identified through the IR&D program, will be in routine use in the software engineering community.*



### INDEPENDENT RESEARCH & DEVELOPMENT PROGRAM

Each year, the SEI undertakes several Independent Research and Development (IR&D) projects. These projects serve to (a) support feasibility studies investigating whether further work by the SEI would be of potential benefit, and (b) support further exploratory work to determine whether there is sufficient value in eventually funding the feasibility study work as an SEI initiative.

Projects are chosen based on their potential to mature and transition software engineering practices, develop information that will help in deciding whether further work is worth funding, and set new directions for SEI work.

In FY 2003, the SEI conducted the following IR&D projects:

- Architectural Design Assistant
- A Model-Based Reference Architecture for Mobile Robotics Systems
- System-of-Systems Interoperability
- Sustainment
- Securing Wireless Devices
- Simulation-Based Acquisition Management Training

The projects are described briefly on the next pages and in detail in the SEI technical report *SEI Independent Research and Development Projects*, [www.sei.cmu.edu/publications/documents/03.reports/03tr019.html](http://www.sei.cmu.edu/publications/documents/03.reports/03tr019.html).



### **Architectural Design Assistant**

Software design teams currently must have expertise and experience with quality attributes to use methods to find architectural risks or make architectural design decisions to realize quality-attribute goals. In this project, the SEI investigated the feasibility of using expert-systems technology to codify, promulgate, and make accessible quality-attribute knowledge to enhance software architecture design and analysis. The goal is to create a design assistant to enhance an ordinary software designer's capability so that he or she can perform at the level of an expert software designer with a specific emphasis on quality-attribute-based design and analysis.



### **A Model-Based Reference Architecture for Mobile Robotics Systems**

Many organizations are recognizing that their software-based systems have a great degree of commonality and should be treated as a family of systems or a product line. Similarly, systems are becoming components in systems of systems, and those systems must have an architectural infrastructure in place to facilitate integration and interoperation. A key to understanding and managing the evolution of such systems is the provision of a reference architecture. In this project, the SEI collaborated with Carnegie Mellon's Robotics Institute and its Electrical and Computer Engineering Department to explore the problem of developing a model-based reference architecture that characterizes and predicts performance-critical quality attributes of software-intensive systems.



### **System-of-Systems Interoperability**

Interoperability to achieve information superiority is the foundation on which future combat systems, logistics systems, and other government systems will be constructed. However, interoperability must occur at multiple levels within a program and not just in the operational system. In this project, the SEI studied the full range of barriers to achieving interoperability among systems, including programmatic, constructive, and technical problems, and proposed solutions to those problems.



### Sustainment

The sustainment phase of a system must be considered in software acquisition, but currently software engineering provides little guidance for explicitly and credibly accounting for future considerations and value in early system analysis, design, and architecture. Software engineers and managers alike must understand the potential for tailoring a legacy system for new mission needs and the costs of doing so. Today's tools for assisting in this task are inadequate. In this project, the SEI studied the state of the practice in sustainment in the DoD, evaluated successful sustainment efforts, and documented the characteristics of a sustainable system.



### Securing Wireless Devices

The DoD's view of the future battlefield includes a wide variety of wireless support at all levels, from the command post to the foot soldier. However, experience with wireless technology in non-military applications demonstrates that small portable devices are subject to loss and capture, as are unmanned relay points. In addition, authenticating operators is especially difficult with wireless devices. In this project, the SEI investigated capture-proof wireless for the DoD, authentication for DoD wireless, and location-dependent wireless deployment.



### Simulation-Based Acquisition Management Training

During their training, DoD acquisition personnel have little opportunity to gain experience with the acquisition process. The SEI has seen evidence of this problem in the independent technical assessments it has conducted at DoD locations during the past several years (see page 66). The purpose of this project was to determine the feasibility of applying simulation, gaming, and role-playing techniques to the training of acquisition personnel.

*“The briefing and review were well done, to the point, and fair. This was due, in no small part, to the expertise and common sense of the SEI members of the team.”*

**Dr. William Ballhaus**

President and CEO, The Aerospace Corporation

### INDEPENDENT TECHNICAL ASSESSMENTS

Through independent technical assessments (ITAs), teams from the SEI uncover the causes of problems affecting DoD and civil agency development and acquisition programs and provide recommendations that maximize a program's strengths and minimize and mitigate its risks. ITAs are objective, technical evaluations of 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 six years on mission-critical systems for the DoD and other agencies. Most of the programs evaluated have been procurements of systems with the following application-domain attributes:

- command, control, communications, and intelligence
- information technology
- satellite ground control
- real-time embedded systems
- space-based systems



*“So often, when I hear feedback from a review team (an internal or external team), I spend the majority of the time noting things that obviously were never clearly communicated to them. This time, I had to listen closely because I never found myself writing down ‘perceptions to correct in the future.’ That speaks volumes to the real experience of the team—in software development, in large system management, and in effective listening.”*

**Margaret C. Burns**

Director, Navigation and Weather Programs  
Lockheed Martin Corporation

**In FY 2003, the SEI conducted ITAs for the following programs:**

**DJMPS**

Defense Joint Military  
Pay System

**TCT**

Time Critical Targeting  
Functionality

**GMT**

Ground Mobile Terminal

**CCS-C**

Command and Control  
System Consolidated

**MILPDS #2**

Air Force Military Personnel  
Data System

**GPS OCS**

Global Position System Operational  
Control Segment

**JTT/ITS**

Joint Targeting Toolkit/  
Interim Targeting Solution

**BCS-F**

Battle Control System Fixed

**EDMS**

Electronic Document  
Management Systems

**IRS CADE**

Internal Revenue Service Customer  
Account Data Engine

**JTRS**

Joint Tactical Radio System

**IDECS**

Integrated Budget Documentation  
and Execution System



A custom, spherical high-vacuum chamber from the Kurt J. Lesker Company



**Mike Doyle**  
U.S. Representative

### **TECHNOLOGY INSERTION, DEMONSTRATION, AND EVALUATION (TIDE) PROGRAM**

Like other sectors of the U.S. economy, the defense manufacturing base is evolving. Increasingly, small manufacturing enterprises handle product development. Small manufacturers, however, have been reluctant to employ advances in software technology that have led to dramatic improvements in manufacturing productivity at larger firms. Too often, small enterprises lack the necessary information and resources to support the new technology.

The goal of the SEI Technology Insertion, Demonstration, and Evaluation (TIDE) Program, begun in May 2000, is to improve the profitability and efficiency of small manufacturers by helping them understand the business and technical processes for selecting and integrating commercial software technology. 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 Program and Department of Commerce manufacturing initiatives.

*“We went from having a slow, cumbersome, and crash-prone system that nobody wanted to use to a system that the employees and management now see as a speedy, helpful, reliable tool.”*

**Joe Magdic**

President, Magdic Precision Tooling



### **Application Service Provider Demonstration**

Manufacturing execution systems (MESs) can automate and streamline a whole range of manufacturing tasks. But small firms are often unwilling to implement MES software because of concerns about price and complexity. The SEI is working with a product vendor and an Internet service provider to demonstrate an online MES. This setup, called the application service provider (ASP) model, allows companies to purchase specific capabilities, such as scheduling and tracking, rather than an entire package of manufacturing software. Currently, Mitchell and Westerman, a small manufacturer of packaging materials, is testing the online MES and assessing how well the ASP model serves small manufacturers. In addition, the SEI is evaluating the ASP model with regard to data security, training, support, return on investment, pricing, and overall value.

### **TIDE Demonstrates Benefits with Two Manufacturers**

In FY 2003, the SEI continued its work with the Kurt J. Lesker Company (KJLC) in a project that involved the National Institute of Standards and Technology (NIST). In a move that brought dramatic results, the company migrated from two-dimensional mechanical drafting to a three-dimensional computer-aided design package. This enabled the company to design families of products, rather than design and build individual products essentially from scratch. According to Chief Executive Officer Kurt Lesker, the effort helped the company to achieve a return on investment within the first year by cutting lead times by 35 percent and reducing engineering hours per job by 60 percent.

In another demonstration project, KJLC implemented an MES that enabled dynamic scheduling and enabled simulation tools to operate. Project managers predict a 25-percent increase in capacity, reduced work in progress, improved forecasting ability, and a return on investment within 18 months.

To achieve integration of the scheduling and simulation tools, SEI personnel introduced a software tool designed by NIST, which is a candidate for consideration as a standard by the Institute of Electrical and Electronics Engineers (IEEE).

SEI personnel also worked with Magdic Precision Tooling to implement an integrated MES. The system has enabled Magdic to

- increase shop capacity by 10 percent
- reduce engineering-change turnaround by 50 to 70 percent
- reduce repeat order entry time by 25 percent
- save machine operators 30 to 60 minutes each day in document search time

In addition to these quantifiable benefits, the SEI reported improved decision making, better planning, improved ability to collaborate with customers and suppliers, enhanced innovation, and improved employee morale.

*"I continue to be impressed by the quality and responsiveness of support from the entire team there at the SEI. On behalf of myself and TeraQuest, please extend our thanks to the team for all that they do."*

**George Brotbeck**  
TeraQuest

**80** Organizations  
sponsoring  
176 CMMI  
instructors

**147** Organizations  
sponsoring  
267 SCAMPI  
Lead Appraisers

**27** Organizations  
sponsoring 216  
instructors for  
Personal Software  
Process (PSP) courses

**39** SEI-authorized  
Team Software  
Process (TSP)  
launch coaches

A list of SEI Partners appears on pages 94–97. For the latest information about the SEI Partner Network and its members, see [www.sei.cmu.edu/partners](http://www.sei.cmu.edu/partners).

## THE SEI PARTNER NETWORK

A core element of the SEI mission is to broadly disseminate software engineering knowledge and methods to improve the state of the practice of software engineering worldwide. The SEI Partner Network is a group of organizations and individuals that are selected, trained, and licensed by the SEI to deliver authentic SEI services. These services include courses, consulting methods, and management processes that aid in the implementation of the SEI's software engineering technologies. By delivering services worldwide, the SEI Partners provide a distribution channel for accomplishing the SEI mission. The SEI stands behind the SEI Partner Network and is accountable for the skills and training of SEI Partner-sponsored individuals.

In the past, the SEI Partners were called transition partners. The SEI has changed the name to emphasize the role of the SEI Partners as providers of official SEI-brand services. The SEI Partner Network expanded to 188 members in FY 2003, up from 115 in 2002. As of March 2004, the Partner Network comprised 214 members.

### Services Available from SEI Partners

In 2003, the SEI added training and evaluation services for network security and survivability, and will add software architecture training in 2004. Products and services currently available through the SEI Partner Network include

#### Process Improvement

- the SEI Introduction to CMMI course
- SCAMPI Appraisal Services
- the PSP curriculum
- TSP launch coaching services

#### Security and Survivability

- OCTAVE training and evaluation services
- the CERT course suite

#### Software Architecture

- the SEI Software Architecture: Principles and Practices course (available from partners in late 2004 or early 2005)

*"I truly thank your fine institution for the great contributions to our Armed Forces over the years. My military career has soared to tremendous heights due to the SEI's direct mentorship via books, programs, and seminars... I would love to share to my commander, soldiers, and fellow coworkers how exciting and rewarding it is being affiliated to the SEI by becoming a member!"*

**SFC Ned H. Kelley, Jr.**  
SFC, U.S. Army



### SEI MEMBERSHIP PROGRAM

The SEI Membership Program works to foster the relationship between the SEI and its outside constituents. The SEI Membership Program has three customized levels from which potential members can choose. Individual membership is designed for the software engineering leader interested in priority access to SEI technologies and events that support the transition of software engineering standards and best practices. Individual members represent many different professional arenas; the SEI has members from industry, academia, DoD, and other government organizations. This past year, two new levels of membership were created: group and student. Group memberships are available at a discounted rate when five or more individuals from one organization become members. The student membership program provides an opportunity for undergraduate and graduate students to establish a connection with the SEI and improve their own professional credentials in the process.

Through the network of program services and benefits, members receive a wealth of knowledge and expertise from the software engineering community. SEI members receive a weekly email newsletter, *The Bulletin*, and have access to a members-only Web site, the Member Center, where they can find the latest SEI news and browse the member directory. Members also receive discounts on the Software Engineering Process Group (SEPG) Conference, SEI merchandise, and one SEI public course per year. Other publications that members receive include *The Monitor Monthly*, a members-only newsletter with news about the program, and *news@sei*, a quarterly magazine that covers SEI programs and activities.





### CONFERENCES

The SEI sponsors or cosponsors many conferences, workshops, and user-group meetings throughout the year, and SEI staff members also serve in leadership roles in events sponsored by other organizations. The following pages describe important software engineering events in which the SEI was involved in FY 2003.





### SOFTWARE ENGINEERING PROCESS GROUP (SEPG) CONFERENCE

February 24-27, 2003  
Boston, Massachusetts  
[www.sei.cmu.edu/sepg/](http://www.sei.cmu.edu/sepg/)

More than 1,500 software professionals attended the 15th annual SEPG conference, the leading international conference and exhibit showcase for software process improvement. The conference featured keynote presentations from Tom Davenport, director of the Accenture Institute for Strategic Change and well-known author and authority on business process reengineering, knowledge management, and enterprise systems; Allan Woods, vice chairman and chief information officer of Mellon Financial Corporation; and Dr. Bill Hancock, vice president and chief security officer of Exodus, a cable and wireless service, where he is responsible for global security for one of the world's largest hosting companies and IP networks.

SEPG 2003 also included a news conference and panel discussion about the relationship between security and software quality, with an emphasis on the SEI Team Software Process (TSP). Carol Grojean of Microsoft joined the SEI's Steve Cross, Watts Humphrey, and Rich Pethia on the panel and presented compelling data about the positive impact of TSP on cost, schedule, and quality for the project she leads.

#### Presentations by SEI Staff at SEPG 2003

Albert, C.; Brownsword, L. "Meeting the Challenges of COTS-Based Systems"

Allen, J. "What Is My Role in Information Survivability? Why Should I Care?"

Brantly, D.; Davis, N. "Introducing the TSP Across Geographically Distributed Sites"

Chassis, M.; Konrad, M.; Phillips, M. "CMMI V1.1 - 'I'mproving and 'I'ntegrating"

Davis, N. "Project Planning and Tracking With Self-Directed Teams"

Florac, W.; Sivi, J. "Tools and Techniques for Analyzing Your Software Data"

Forrester, E. "TCM in High-Maturity Organizations"

Garcia, S. "Are You Prepared for CMMI?" and "Designing Role-Based Training"

Hayes, W.; Kitson, D.; Miluk, G. "A Family of SCAMPI Appraisal Methods"

Humphrey, W. "Commitments: Their Use and Abuse" and "Teams and Teamwork"

Kitson, J.; Svolou, A. "Lessons Learned from a Piloted Class C Appraisal"

McHale, J.; Mishler, J.; Sisti, F. "Can PSP/TSP Methods Be Applied to ERP Implementation?"

Moore, A. "Intrusion-Aware Design: A Process Overview"

Musson, R. "Profitability Implications of the TSP"

Myers, C. "Over, Under, Around, and Through: Using the CMMI Continuous and Staged Representations Together to Optimize Process Improvement"

Over, J. "Self-Directed Software Teams"

Willett, A. "Planning SPI with TSP"

Zubrow, D. "CMMI Maturity Profile"

### AUSTRALIAN SOFTWARE AND SYSTEMS ENGINEERING PROCESS GROUP CONFERENCE 2003 (AUSTRALIAN SEPG)

September 24-26, 2003  
Queensland, Australia  
[www.sqi.gu.edu.au/austsepg/](http://www.sqi.gu.edu.au/austsepg/)

The inaugural Australian SEPG conference built on the success and reputation of SEPG conferences held in the United States, Europe, and Asia over the past 16 years. The conference focused on Australian experiences with process improvement in systems and software engineering, and its application to the acquisition of large and complex systems.

#### Presentations and Tutorials by SEI Staff at Australian SEPG 2003

Graettinger, C. "I Hired Employees and People Showed Up: Mastering the Hidden Human Forces in Technology Adoption" (keynote)

Phillips, D. "CMMI: Improving and Integrating" and "CMMI Appraisals"

### EUROPEAN SYSTEMS AND SOFTWARE PROCESS ENGINEERING PROCESS GROUP CONFERENCE (E-SEPG)

June 16-19, 2003  
London, England  
[www.espi.org/](http://www.espi.org/)

The eighth annual E-SEPG conference brought together leaders, innovators, and practitioners from Europe and around the world to explore methods, tools, and process improvements that aim to increase business performance through quality and productivity gains. An exhibitor showcase featured some of Europe's leading process-improvement product and service providers.

#### Presentations by SEI Staff at E-ESEPG 2003

Brownsword, L.; Albert, C. "Evolutionary Process for Integrating COTS-Based Systems"

Chittister, C. "Improving Processes for Better Products," "SEI Technical Review"

Curtis, B. "Integrating CMMI with CobiT and ITIL"

Davis, N. "Self-Directed Teams: A Case Study," "Building Secure Systems with the Team Software Process"

Gallagher, B. "Using the CMMI to Identify Internet Development Constraints"

Hayes, W. "Developing Enterprise-Wide Measures for Tracking an Organisation's Performance"

Humphrey, W. "Being Disciplined While Agile"

Humphrey, W.; Northrop, L. "Starting Right"

McHale, J. "From TSP to CMM to CMMI"

Phillips, M. "Safety and Security: Including 'Integrity Assurance' in the CMMI Framework"

Siviy, J. "Leveraging CMMI and Six Sigma for Software Process Improvement"

Tyson, B.; Brownsword, L.; Albert, C. "Using CMMI for COTS-Based Systems"

### **CMMI TECHNOLOGY CONFERENCE & USER GROUP**

November 11-14, 2002  
Denver, Colorado  
[www.sei.cmu.edu/cmml/events/cmml-techconf.html](http://www.sei.cmu.edu/cmml/events/cmml-techconf.html)

The Systems Engineering Division of the National Defense Industrial Association (NDIA), in conjunction with the SEI, presented this conference to bring together the users, adopters, and developers of Capability Maturity Models (CMMs) to exchange ideas, concepts, and experiences with the use of maturity models and appraisal methods.

#### **Presentations by SEI Staff at the 2003 CMMI Technology Conference & User Group**

Ferguson, J. "Use of CMMI in an Acquisition Context"

Garcia, S. "Preliminary Insights Working with CMMI in Small Organizations"

Garcia, S.; Miluk, G.; Cepeda, S.; Staley, M. "CMMI for Small Business Pilot Project"

Goldenson, D. "Evidence About the Benefits of CMMI: What We Already Know and What We Need to Know"

Goldenson, D.; Gibson, D.; Ferguson, R. "Why Should I Switch to CMMI? Initial Evidence About Impact and Value Added"

Kasunic, M. "Fiscal Year 2003 Survey of Acquisition Project Managers"

Kitson, D. "The SCAMPI Appraisal Method: Top Ten Misperceptions"

McHale, J. "Mapping TSP to CMMI"

### **SOFTWARE ENGINEERING FOR HIGH ASSURANCE SYSTEMS (SEHAS 2003)**

May 9-10, 2003  
Portland, Oregon  
[www.sei.cmu.edu/community/sehas-workshop/](http://www.sei.cmu.edu/community/sehas-workshop/)

Held in conjunction with the International Conference on Software Engineering (ICSE), the SEHAS 2003 workshop provided a forum for researchers and practitioners to exchange ideas and experiences relevant to the development of high-assurance software systems—systems for which proof is required that they meet certain critical properties, such as security, safety, survivability, and fault tolerance.

#### **Paper by SEI Staff at SEHAS 2003**

Mead, N. "Life-Cycle Models for High-Assurance Systems"

### **INTERNATIONAL WORKSHOP ON REQUIREMENTS FOR HIGH ASSURANCE SYSTEMS (RHAS 2003)**

September 9, 2003  
Monterey, California  
[www.sei.cmu.edu/community/rhas-workshop/conf2.html](http://www.sei.cmu.edu/community/rhas-workshop/conf2.html)

Held in conjunction with the IEEE International Requirements Engineering Conference, this workshop brought together researchers and practitioners from the fields of secure computing and software requirements to exchange ideas and experiences.

#### **Presentation by SEI Staff at RHAS 2003**

Firesmith, D. "Reusable Security Requirements"

### INTERNATIONAL CONFERENCE ON COTS-BASED SOFTWARE SYSTEMS (ICCBSS)

February 10-12, 2003  
Ottawa, Canada  
[www.iccbss.org](http://www.iccbss.org)

ICCBSS provides researchers and practitioners with a forum for posing questions and describing their experiences from working with commercial off-the-shelf (COTS) software in large or critical systems.

ICCBSS 2003: Multiple Paths, Multiple Solutions built on the success of the first ICCBSS conference with an expanded program of tutorials, presented papers, experience presentations, a poster session, and panel discussions.

#### Presentations by SEI Staff at ICCBSS 2003

Brownsword, L.; Albert, C.; Tyson, B. "Implications of Using the Capability Maturity Model Integration (CMMI) for COTS-Based Systems"

Morris, E.; Albert, C.; Brownsword, L. "COTS-Based Development: Taking the Pulse of a Project"

Robert, J.; Garcia, S.; Buhman, C.; Allinder, D. "Bringing COTS Information Technology into Small Manufacturing Enterprises"

Sai, V. "COTS Acquisition Evaluation Process: The Preacher's Practice"

### ACQUISITION OF SOFTWARE-INTENSIVE SYSTEMS CONFERENCE

January 28-30, 2003  
Arlington, Virginia  
[www.sei.cmu.edu/products/events/acquisition/](http://www.sei.cmu.edu/products/events/acquisition/)

Sponsored by the Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics and the SEI, this conference provides an opportunity for employees of government acquisition organizations, their support agencies, and federal government contractors to share experiences and insights about software acquisition.

The conference focused on improving the acquisition of software-intensive systems throughout government.

It drew from the experience and expertise of practitioners in the field to provide insights for acquisition professionals who are trying to enhance the effectiveness of their methods and techniques.

More than 200 people participated, representing organizations such as the U.S. Department of Defense, Internal Revenue Service, National Aeronautics and Space Administration, and the Federal Aviation Administration.

#### Presentations by SEI Staff at the 2003 Acquisition of Software-Intensive Systems Conference

Albert, C.; Brownsword, L. "They Keep Moving the Cheese! A Framework for Evolutionary Acquisition of Large Software-Intensive Systems"

Bergey, J.; Fisher, M.; Jones, L. "Reducing System Acquisition Risk with Software Architecture Analysis and Evaluation"

Campbell, G. "Software Product Lines in Acquisition"

Goethert, W.; Lucero, S.; Zubrow, D. "Developing Enterprise-Wide Measures for Tracking Acquisition Performance"

Graettinger, C.; Garcia, S.; Ferguson, J. "TRL Corollaries for Practice-Based Technologies"

Hageman, L.; Dailey, T.; Kennedy, J. "NAVAIR/SEI/MITRE Strategic Collaboration"

Kasunic, M. "Measuring Systems Interoperability"

Marz, T.; Smith, J. "The State of Practice in DoD Acquisitions, and Some Proposed Alternatives"

Mishler, J.; Sisti, F. "Defining Acquisition Measures: The Integrated Software Acquisition Metrics (ISAM) Project"

Mularz, D.; Smith, J.; Hybertson, D. "Enterprise Architecture and COTS-Intensive System Acquisition Strategies"

Oberndorf, P.; Place, P. "Acquisition Practices: Good and Bad"

Ouellette, F.; Barbour, R. "Fourteen SCEs Around the World in Less Than 40 Days"

### DOD SOFTWARE PRODUCT LINE WORKSHOP

The SEI sponsored and organized its sixth DoD Software Product Line Workshop in September of 2003. Attendees agreed that this workshop was the best yet in terms of both the quality of the presentations and the significance of the DoD product line experiences shared. Positive results from recently adopted product line approaches influenced by the SEI were shared by Rockwell Collins (a contractor for the U.S. Army Technology Applications Program Office [TAPO]), Argon Engineering (a defense contractor), and the Naval Undersea Warfare Center. Other participants included Aerospace Corporation, Army Aviation and Missile Command, Army Training Support Center, Force XXI Battle Command Brigade and Below (FBCB2), and the Joint National Integration Center.

A highlight of the workshop was the presentation on the SEI's work with TAPO. In 1998, TAPO engaged the SEI to help the DoD organization realize its vision of a software product line for the Army's special operations helicopters. At the workshop, Rockwell Collins (TAPO's contractor) reported that this vision has now been realized through an open systems architecture and common avionics software for the MH-47, MH-60, and MH/AH-6 helicopters.

The Army is planning to adopt the same software product line to meet the needs of the entire fleet of Army helicopters. Rockwell Collins reports the following benefits from the software product line:

- easy insertion of new technology
- ability to swap multifunction displays and over-avionics equipment from one helicopter avionics system to another with automatic reconfiguration
- integration of subsystems by third-party developers through well-defined application program interfaces

Another highlight of the workshop was Argon Engineering's presentation. Argon—a developer of communication systems that search, identify, and capture signals—uses SEI-defined product line practices to develop and deploy many of its systems. It reported increased customer satisfaction, shorter development cycles, and decreased costs. Data Argon presented confirmed the return on investment reported by the SEI in other product line studies.

**Presentation by SEI Staff at the DoD Software Product Line Workshop**  
Northrop, L. "Software Product Lines"

**FY 2004 CONFERENCES**

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**FOURTH ANNUAL CMMI  
TECHNOLOGY CONFERENCE &  
USER GROUP**

Denver Technical Center,  
Denver, Colorado  
[www.sei.cmu.edu/cmml/events/cmml-techconf.html](http://www.sei.cmu.edu/cmml/events/cmml-techconf.html)

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**THIRD INTERNATIONAL  
CONFERENCE ON COTS-BASED  
SOFTWARE SYSTEMS**

Crowne Plaza Redondo Beach &  
Marina, Redondo Beach, California  
[www.iccbss.org/2004/](http://www.iccbss.org/2004/)

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**16TH SOFTWARE ENGINEERING  
PROCESS GROUP CONFERENCE  
(SEPG 2004)**

Orlando World Center Marriott,  
Orlando, Florida  
[www.sei.cmu.edu/sepg/](http://www.sei.cmu.edu/sepg/)

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**SOUTHEASTERN SOFTWARE  
ENGINEERING CONFERENCE**

The Von Braun Center,  
Huntsville, Alabama  
[www.ndia-tvc.org/SESEC/](http://www.ndia-tvc.org/SESEC/)

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**THIRD SOFTWARE PRODUCT  
LINE CONFERENCE (SPLC 2004)**

The Langham,  
Boston, Massachusetts  
[www.sei.cmu.edu/SPLC2004/](http://www.sei.cmu.edu/SPLC2004/)

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**NINTH ANNUAL EUROPEAN  
SYSTEMS & SOFTWARE  
ENGINEERING PROCESS GROUP  
CONFERENCE**

London Novotel West,  
London, England  
[www.espi.org](http://www.espi.org)

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**SOFTWARE ENGINEERING  
PROCESS GROUP LATIN  
AMERICA (SEPG-LA) 2004**

Guadalajara, Mexico  
[www.esi.es/SEPLA/index\\_eng.html](http://www.esi.es/SEPLA/index_eng.html)



10

ACQUISITION

ARCHITECTURE

ASP

ATAM

CERT/CC

CMMI

COTS

CREDENTIALS

CURE

ICCBSS

OCTAVE

PCS

PLTP

PRODUCT LINES

PSP

SCAMPI

SECURITY

SEI-EUROPE

SEIR

SEMA

SEPG

SOFTWARE

SPINS

SPLC

SYSTEMS INTEGRATION

SYSTEM OF SYSTEMS

TRANSITION

TSP

# SEI STAFF INFORMATION & TRANSITION ACTIVITIES

## TECHNICAL LEADERSHIP POSITIONS

### Barbacci, M.

juror, Institute of Electrical and Electronics Engineers (IEEE) Computer Society International Design Competition Finals, Washington, DC, June 30-July 1, 2003

### Bass, L.

Association for Computing Machinery (ACM) representative, technical committee on Software: Theory and Practice, International Federation of Information Practice

co-organizer, International Conference on Software Engineering (ICSE) 2003 Workshop on "Bridging the Gap Between HCI and Software Engineering," Portland, OR, May 3-10, 2003

editorial board member, *Universal Access to the Information Society*

member, NASA Goddard Space Flight Center Information Science and Technology Visiting Committee  
session chair, 10th International Conference on Human-Computer Interaction (HCI), Crete, Greece, June 22-27, 2003

### Blanchette, Jr., S.

abstract reviewer, 16th Annual Software Technology Conference

article referee, *Computer*

article referee, *IEEE Software*

### Brownsword, L.

program committee, Workshop on COTS and Product Software: Why Requirements Are So Important, 11th IEEE International Requirements Engineering Conference 2003, Monterey Bay, CA, September 10, 2003

### Carpenter, J.

program committee member, Forum of Incident Response and Security Teams (FIRST) Conference, Ottawa, Canada, June 22-27, 2003

### Chrissis, M.

member, IEEE Software Engineering Standards Committee (SESC) Executive Committee

### Clements, P.

member, technical committee on software architecture, International Federation of Information Practice

program committee member, ICSE 2003, Portland, OR, May 2003

program committee member, Twente Workshop on Model-Driven Architecture, Enschede, Netherlands, June 26-27, 2003

program committee member, 2003 Workshop on Product Line Economics (Early Stages), Erfurt, Germany, September 2003

steering committee member, Argentine Symposium on Software Engineering, Buenos Aires, September 1-3, 2003

steering committee member, Early Aspects 2003: Aspect-Oriented Requirements Engineering and Architecture Design, Boston, MA, March 17-21, 2003

### Dailey, T.

member, National Defense Industrial Association (NDIA) Science & Engineering Technology Advisory Board

### Davis, N.

program committee member, XP/Agile Universe Conference 2003, New Orleans, LA, August 11-14, 2003

### Feiler, P.

program committee member, 23rd International Conference on Distributed Computing Systems, Providence, RI, May 19-22, 2003

program committee member, ICSE 2003, Portland, OR, May 3-10, 2003

subcommittee member, Society of Automotive Engineers (SAE)

secretary, coauthor, and editor, Architecture Analysis and Design Language standard (AADL/SAE-AS2C)

### Firesmith, D.

program committee member, International Workshop on Requirements for High Assurance Systems (RHAS), Monterey, CA, September 9, 2003

### Gallagher, B.

representative, NDIA Systems Engineering Division

### Goldenson, D.

program committee member, Third International Software Process Improvement and Capability Determination (SPICE) Conference on Process Assessment and Improvement, Noordwijk, The Netherlands, March 17-21, 2003

### Gross, C.

area editor, *IEEE Software Engineering Online for Quality and Quality Assurance*

### Hissam, S.

co-organizer, ICSE 2003 Third Workshop on Open Source Software Engineering, Portland, OR, May 3, 2003

executive advisory committee, Lane Department of Computer Science and Electrical Engineering, West Virginia University, Morgantown, WV, November 8, 2002

### Hudak, J.

member, Industrial Advisory Board, University of Pittsburgh-Johnstown, School of Engineering, Electrical and Computer Engineering

### Jones, L.

member, executive committee, and commissioner, Accreditation Board for Engineering and Technology (ABET) Computing Accreditation Commission evaluation team, Ministry of Higher Education and Scientific Research, United Arab Emirates

member, Resource Council, Engineering Credentials Evaluation International representative director, ACM Computing Sciences Accreditation Board

### Kazman, R.

co-organizer, Dagstuhl Workshop 0306, Software Architecture Recovery and Modeling, February 2-7, 2003

co-organizer, workshop on "Bridging the Gap Between HCI and Software Engineering," ICSE 2003, Portland, OR, May 3-10, 2003

### King, B.

member, National InfraGard Board of Directors

### Laswell, B.

board member, Joint Council on Information Age Crime

### Levine, L.

vice chair, International Federation for Information Processing (IFIP) Working Group 8.6 on Diffusion, Transfer, & Implementation of Information Technology

### Lewis, G.

executive committee member, Master of Software Engineering Program, Carnegie Mellon University

member, School of Computer Science Alumni Advisory Board, Carnegie Mellon University

### Lipson, H.

chairman, advisory board, Computational Mathematics Master's Degree Program, Duquesne University

panel chair, "Definitions, Frameworks, and Risk Assessments," Conference on EU/US Cooperation for the Prevention of Computer-Related Crime, European Union Center, University of Pittsburgh, October 4-5, 2002

program committee member, First ACM Workshop on Survivable and Self-Regenerative Systems (ACM SSRS '03)

steering committee member, IEEE Information Survivability Workshops

**Little, R.**

member, DoD High-Level Architecture (HLA) Interpretations Committee  
 member, Simulation Interoperability Standards Organization (SISO) Board of Directors  
 member, IEEE/SISO Standards Activity Committee  
 program committee member, SISO Simulation Interoperability Workshop

**Mead, N.**

board member, *Requirements Engineering Journal*  
 editorial board member, *IEEE Security & Privacy*  
 panel chair, Symposium on Requirements Engineering for Information Security, Raleigh, NC, October 16, 2002  
 steering committee chair, Conference on Software Engineering Education & Training  
 steering committee member, International Requirements Engineering Conference  
 task force member, *IEEE Security & Privacy*  
 workshop co-chair, RHAS 2003, Monterey, CA, September 9, 2003  
 workshop co-chair, Workshop on Software Engineering for High-Assurance Systems, ICSE, Portland, OR, May 3-10, 2003

**Nord, R.**

member, International Federation for Information Processing (IFIP) Working Group 2.10 Software Architecture  
 program committee member, Fifth International Workshop on Product Family Engineering

**Northrop, L.**

advisory committee, Ground System Architecture Workshop, 2003  
 co-organizer, Dagstuhl Seminar on Product Family Development, April 7-10, 2003, Dagstuhl, Germany  
 member, nominating committee for Carnegie Science Center Awards for Excellence, 2003  
 steering committee chair, ACM Conference on Object-Oriented Programming, Systems, Languages, and Applications (OOPSLA)  
 steering committee chair, Software Product Line Conference (SPLC)  
 program committee, Aspect-Oriented System Development Conference, Enschede, Netherlands, November 21-22, 2002

**Oberndorf, P.**

program co-chair, Second International Conference on COTS-Based Software Systems (ICCBSS), Ottawa, Canada, February 10-12, 2003

**O'Brien, L.**

program committee member, Working Conference on Reverse Engineering 2002, Richmond, VA, October 28-November 1, 2002  
 program co-chair, Software Technology and Engineering Practice, Amsterdam, The Netherlands, September 19-21, 2003

**Palmquist, M.**

member, Information and Command and Control Technical Committee, American Institute of Aeronautics and Astronautics

**Peterson, W.**

conference co-chair, Eighth Annual European Software and Systems Engineering Process Group Conference, London, UK, June 16-19, 2003

**Phillips, D.**

chair, 15th Software Engineering Process Group Conference (SEPG 2003), Boston, MA, February 24-27, 2003  
 co-chair, Eighth Annual European SEPG Conference, London, UK, June 16-19, 2003

**Robert, J.**

publicity chair, ICCBSS 2003, Ottawa, Canada, February 10-12, 2003

**Sharygina, N.**

special editor, *Formal Methods in System Design*  
 program committee member, European Software Engineering Conference and ACM SIGSOFT Symposium on the Foundations of Software Engineering 2003 workshop on Specification and Verification of Component-Based Systems

**Siviy, J.**

co-chair, International Council on Systems Engineering (INCOSE) Measurement Working Group  
 series editor, *Software Quality Professional*, September 2003  
 secretary and Six Sigma focus group, American Society for Quality, Pittsburgh Section  
 tutorial co-chair, International Council on Systems Engineering Symposium 2003, Rochester, NY

**Smith, D.**

chair, steering committee, Software Technology and Engineering Practice  
 chair, steering committee of International Workshop on Program Comprehension  
 member, steering committee, International Conference on Software Maintenance  
 member, organizing committee, Third International Workshop on Adoption-Centric Software Engineering, May 9, 2003, Portland, OR

**Stafford, J.**

co-organizer, Sixth ICSE Workshop on Component-Based Software Engineering at ICSE 2003, Portland, OR, May 3-10, 2003

**Wallnau, K.**

co-organizer, Sixth ICSE Workshop on Component-Based Software Engineering, Portland, OR, May 3-10, 2003  
 program committee member, Specification and Verification of Component-Based-Systems workshop, Foundations of Software Engineering Conference, Charleston, SC, November 20-22, 2002

**Weinstock, C.**

editor, *FT News*, newsletter of the IEEE Computer Society Technical Committee on Fault-Tolerant Computing  
 general chair and steering committee, International Conference on Dependable Systems and Networks, San Francisco, CA  
 Workshop Organizer, IFIP Working Group 10.4 Summer 2003 Meeting, Monterey, CA, June 2003

**Williams, R.**

board member, Risk Management Specific Interest Group (RiskSIG) of the Project Management Institute (PMI)

**Zubrow, D.**

associate editor, *Software Quality Newsletter*  
 editorial board member, *Software Quality Professional*  
 program committee member, 9th IEEE International Software Metrics Symposium, Sydney, Australia, September 3-5, 2003

**TECHNICAL STAFF DEMOGRAPHICS**

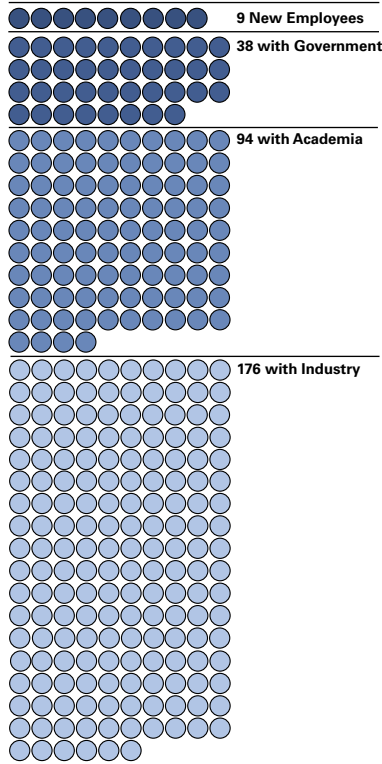
SEI staff members include technical staff, support staff, affiliates, and visiting scientists. SEI employment figures as of September 30, 2003:

- 317 technical staff, including 72 visiting scientists
- 133 support staff
- 16 affiliates

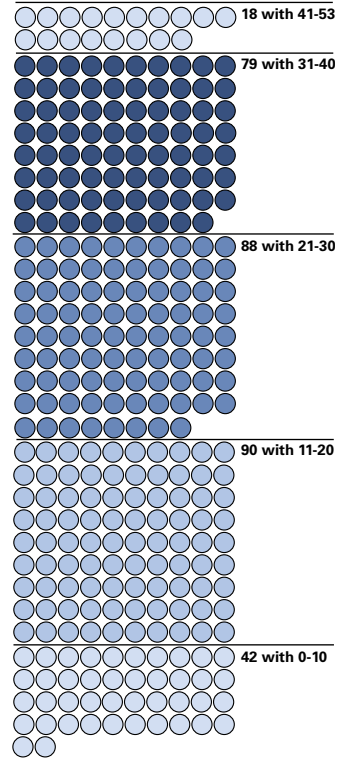
**SEI Affiliate Program**

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 200 affiliates to date. Affiliates' sponsoring organizations represent industry (67%), government (20%), and academia (13%).

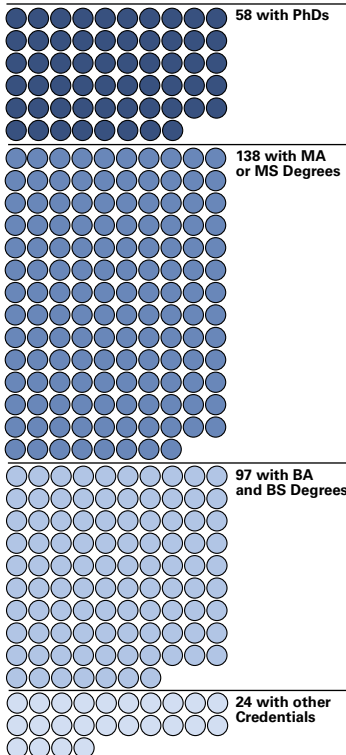
**Previous Affiliation**



**Years of Experience**



**Credentials**





**AJ Award winner James McCurley with SEI Director Stephen E. Cross**



**Stephen E. Cross with Angel Jordan**

## THE AJ AWARDS

### Rewarding Exemplary Achievements

The AJ Awards (named for Angel Jordan, distinguished Carnegie Mellon professor, dean, provost, SEI founding father, and acting SEI director) are a tribute to the SEI core values of integrity, excellence, and impact embodied by SEI staff.

The AJ Awards recognize those individuals and teams whose teamwork crosses organizational boundaries and whose outstanding commitment has had a significant impact on the SEI in one of the following categories:

### Contribution

Nominees for the AJ Award for Contribution are those whose achievements are notable for the degree to which they resulted in a lasting positive change to the SEI or its constituency. These nominees “have made an exceptional difference” to the SEI, Carnegie Mellon University, a specific customer, a collection of customers, or the software engineering community.

#### Recipient

*Technical Analysis Team,  
CERT Analysis Center  
Mike Collins, Marc Kellner,  
Suresh Konda, James McCurley*

### Dedication

Nominees for the AJ Award for Dedication take great pride in their work. They consistently serve their internal and external customers through their personal commitment to a job well done, striving for excellence in everything they do. They bring a positive and productive perspective to their work with both energy and enthusiasm. They are dedicated to the SEI’s mission. Along with their dedication, they represent the SEI by being open and objective, striving for solutions that will benefit both the SEI and the customer.

#### Recipient

*Jan Vargas,  
Program Integration Directorate*

### Innovation

Nominees for the AJ Award for Innovation have developed new approaches, methods, and systems that benefit the SEI or its constituents. They have demonstrated imagination and creativity in finding solutions to problems or fostering change. They are the visionaries who have discovered new paths to excellence and implemented a plan to achieve that excellence.

#### Recipient

*Suresh Konda, Networked Systems  
Survivability Program*

### The Angel Jordan Award for Excellence

In the inaugural year of the AJ Awards, this special award was presented to Dr. Angel Jordan for his devoted collaboration, advocacy, and sponsorship of the SEI, for inspiring a commitment to excellence, and for his allegiance to the SEI’s mission.



## SEI-PUBLISHED DOCUMENTS

- 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 nontechnical 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.

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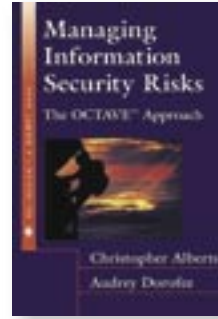
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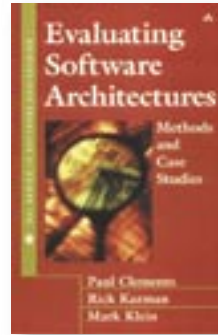
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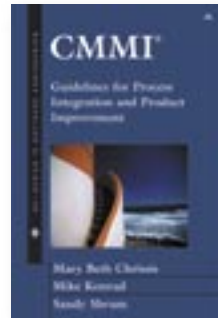
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**Anderson, B.**

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“Dimensions of Order in Engineering Design Organizations,” *Design Studies* 24, 4 (July 2003): 357-353

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**Clements, P.**

"Software Architecture in Practice," Hungarian Software Technology Forum, Budapest, Hungary, December 11, 2002

"Software Product Lines: Reuse that Pays," Motorola Software Engineering Symposium, Chicago, IL, July 22, 2003

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"I Hired Employees and People Showed Up: Mastering the Hidden Forces in Technology Adoption," Australian SEPG Conference 2003, Gold Coast, Queensland, Australia, September 24, 2003

**Humphrey, W.**

"Educating Software Professionals," Consortium of Computing in Small Colleges: Eastern 2002 Conference, Bloomsburg, PA, October 18, 2002

"What If Your Life Depended on Software?" Bosch Software Conference, Stuttgart, Germany, October 1, 2002

"What Is Excellence?" International Conference on Software Process Improvement, Adelphi, MD, November 20, 2002

**Humphrey, W.; Northrop, L.**

"Starting Right," The Eighth Annual European Software Engineering Process Group Conference, London, UK, June 16-19, 2003

**Kazman, R.**

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**Killcrece, G.**

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**Konrad, M.**

"Future of CMMI (SPI/SPA)," Software Engineering Process Symposium, Tokyo, Japan, July 3-4, 2003

"CMMI: Success and Opportunities Ahead," Second Annual QAAM Conference, Maryland, October 22-23, 2003

**Little, R.**

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**Oberndorf, P.**

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**Phillips, D.**

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**Zubrow, D.**

"Measurement in a Process Framework," Osellus Process & Methodology Seminar, Toronto, Canada, September 30, 2003

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**Barbacci, M.**

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**Bass, L.; John, B.**

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**Cohen, S.**

"Software Product Line Technology," IEEE Computer Society, Israel Chapter, November 6, 2002

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"Documenting Software Architectures: Views and Beyond," International Conference on Software Engineering (ICSE), Portland, OR, May 2003

**Davis, N.**

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"Self-Directed Teams: A Case Study," Software Developer Conference East, Boston, MA, September 16-18, 2003

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"TSP Principles," USC Research Review, Los Angeles, CA, March 18-19, 2003

**Feiler, P.; Lewis, B.; Vestal, S.**

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**Forrester, E.; Garcia, S.**

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**Garcia, S.**

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**Garcia, S.; Glover, M.**

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**Humphrey, W.; Over, J.**

"The Personal Software Process (PSP) Tutorial," 27th Annual NASA Goddard Software Engineering Workshop, Greenbelt, MD, December 5-6, 2002

**Killcrece, G.**

"Creating an Incident Response Team," Security Professionals Workshop, Temecula, CA, April 22-23, 2003

**Killcrece, G.; Ruefle, R.; Zajicek, M.**

"Creating and Managing a CSIRT," 15th Annual FIRST Conference, Ottawa, Canada, June 22-27, 2003

**Laswell, B.**

"Building Cyber Security Capabilities at the State Level," State Governments Cyber Security Consortium, Pittsburgh, PA, April 10, 2003

"Building Global CSIRT Capabilities," Southeast Europe Cyber Security Conference, U.S. Department of State and USAID, Sofia, Bulgaria, September 8-9, 2003

"Building Global Cyber Security Capabilities," ISAlliance-Japan IT Delegation, Arlington, VA, July 30, 2003

"CERT-Certified Computer Security Incident Handler Program," Annual DISA Department of Defense Technical Exchange, Falls Church, VA, August 27, 2003



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**Little, R.**

“IEEE 1516: The Future of the High Level Architecture,” Eighth Annual International Test and Evaluation Association Modeling and Simulation Conference, Las Cruces, NM, December 9, 2002

“IEEE 1516: The Future of the High Level Architecture,” European Simulation Interoperability Workshop, Stockholm, Sweden, June 16, 2003

**Mead, N.; Longstaff, T.**

“Survivable Systems Analysis,” Annual Computer Security Applications Conference, December 9, 2002

**Northrop, L.**

“Software Architecture: Designing for Product Quality,” SpaceTech, Munich, Germany, May 13, 2003

**O’Brien, L.; Smith, D.**

“Mining Components for a Software Architecture and a Product Line: The Options Analysis for Reengineering (OAR) Method,” International Conference on Software Maintenance 2003, Amsterdam, The Netherlands, September 23, 2003

**Phillips, D.**

“CMMI Appraisals,” Australian SEPG Conference 2003, Gold Coast, Queensland, Australia, September 26, 2003

**Siviy, J.**

“Integrating CMMI and Six Sigma in Software and Systems Engineering,” CIMAT Six Sigma Symposium 2002, Aguascalientes, Mexico, November 15, 2002

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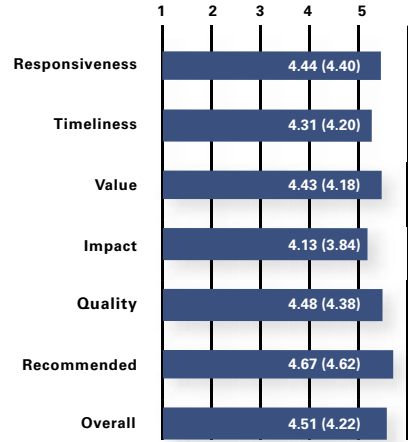
“Issues in Enterprise Integration,” ICSM2002, Montreal, Quebec, October 3, 2002

**Williams, C.; Meinert, L.**

“Analogies [to the Risks in Drug Testing Protocol Violations] from the Software Industry,” Drug Information Association (DIA) Annual Conference, San Antonio, TX, June 16, 2003

**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. This year 54 DoD and other government organizations were surveyed. The chart shows the average ratings using a five-point scale (with five being the highest). The average rating from last year’s survey is shown in parentheses.



Milton Smith, Chief, Fire Support Software Engineering, Fort Sill wrote, “The value provided to FSSE was simply priceless in terms of assisting us to understand and draw an executable path to our goal of achieving the CMMI Level 5 rating. The SEI’s insight and guidance in the transition from the CMM to the CMMI and in the guidance and assistance with the training and conduct of the formal appraisal were key to FSSE’s attaining our goals. The SEI always provided the highest quality support under this PWS. Never was there a reason or need to rework or comment on the validity, direction, content, or service provided.”

90% of all customer responses at 4 or 5

90% of all DoD customer responses at 4 or 5

89% of all civil agency responses at 4 or 5

## PRESS RELEASES

The SEI issued six press releases in FY 2003:

**September 15, 2003**

### **U.S. Department of Homeland Security Announces Partnership with Carnegie Mellon's CERT Coordination Center**

The U.S. Department of Homeland Security announced a partnership with the SEI's CERT Coordination Center to create US-CERT, a coordination point for prevention, protection, and response to cyber attacks across the Internet.

**June 12, 2003**

### **Carnegie Mellon University's Software Engineering Institute Director Accepts Vice President Position at Georgia Institute of Technology**

Stephen E. Cross, director and chief executive officer of the Software Engineering Institute, has announced that he will be leaving the SEI to become a vice president at Georgia Institute of Technology and director of the Georgia Tech Research Institute, effective September 1, 2003.

**April 17, 2003**

### **Software Engineering Institute and U.S. Army Reserve Partner on Information-Assurance Initiative**

Carnegie Mellon University's Software Engineering Institute hosted U.S. Senator Rick Santorum (R-PA) and representatives from the U.S. Army Reserve's Chief Information Officer's office for the launch of a new partnership between the SEI and the Army Reserve Information Operations Command.



**U.S. Senator Rick Santorum (R-PA)**

**November 22, 2002**

### **Johns Hopkins University Applied Physics Lab and Software Engineering Institute Forge Strategic Partnership**

The Johns Hopkins University Applied Physics Laboratory (APL) and the Software Engineering Institute have forged a strategic partnership that combines APL's proven systems engineering experience with the SEI's advanced software expertise.

**October 28, 2002**

### **Software Engineering Institute Celebrates 15th Annual SEPG Conference: Assuring Stability in a Global Enterprise**

The Software Engineering Institute (SEI) will hold its 15th Annual Software Engineering Process Group (SEPG) Conference Feb. 24–27, 2003 at the Hynes Convention Center in historic Boston, Massachusetts. This year's theme is "Assuring Stability in a Global Enterprise."

**October 15, 2002**

### **Carnegie Mellon Enhances International Presence in Software Engineering**

Carnegie Mellon University announces the international expansion of its Software Engineering Institute with the opening of an office in central Frankfurt, Germany.

## GOVERNMENT TESTIMONY

**Hernan, S.**

"Digital Millennium Copyright Act (DMCA)—Comments and Testimony to the Library of Congress Copyright Office." December 18, 2002; comments to the Copyright Office; May 2, 2003: testimony at the Rulemaking Hearing, [www.cert.org/congressional\\_testimony/dmca.html](http://www.cert.org/congressional_testimony/dmca.html).

**Pethia, R.**

"Viruses and Worms: What Can We Do About Them?" Testimony to the House Subcommittee on Technology, Information Policy, Intergovernmental Relations and the Census. September 10, 2003, [www.cert.org/congressional\\_testimony/Pethia-Testimony-9-10-2003](http://www.cert.org/congressional_testimony/Pethia-Testimony-9-10-2003).

"Cyber Security—Growing Risk from Growing Vulnerability." Testimony to the House Select Committee on Homeland Security, Subcommittee on Cybersecurity, Science, and Research and Development. June 25, 2003, [www.cert.org/congressional\\_testimony/Pethia\\_testimony\\_06-25-03.html](http://www.cert.org/congressional_testimony/Pethia_testimony_06-25-03.html).

"Information Technology—Essential But Vulnerable: Internet Security Trends." Testimony to the House of Representatives Committee on Government Reform, Subcommittee on Government Efficiency, Financial Management, and Intergovernmental Relations. November 19, 2002, [www.cert.org/congressional\\_testimony/pethia-11-02/Pethia\\_testimony\\_11-19-02.html](http://www.cert.org/congressional_testimony/pethia-11-02/Pethia_testimony_11-19-02.html).

## MEDIA COVERAGE

During this fiscal year, SEI staff members participated in 393 interviews with members of the news media. Articles appeared in more than 150 major and trade publications. Staff members provided information about such topics as the SoBig worm, software process improvement, the Blaster worm, cyber security, and various SEI technologies.

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

### **Application Development Trends**

“Don’t Shoot the Programmer: SEI Touts Process Method Update.” March 4, 2003. This article about reducing bugs in software quotes Watts Humphrey and refers to the TSP, PSP, CMM, SEPG, and SEI.

“SEI Talks Up Team Software Process at Boston Event.” February 26, 2003. This report on the SEPG conference mentions Watts Humphrey, the TSP/PSP, and the SEI.

### **Associated Press**

“Homeland Security to Partner with Carnegie Mellon Cyber Emergency Center.” September 15, 2003. The CERT Coordination Center has announced a partnership with the Department of Homeland Security to prevent, protect against, and respond to cyber attacks.

“Computer Worm Blasts PC Users.” August 13, 2003. Art Manion, a security analyst with the CERT/CC, says that Blaster “is not obeying any geographic boundaries. We’ve received reports from around the world. It spread pretty quickly.”

“IRS Delays Switch to New Computer System Until 2004.” July 30, 2003. The IRS has selected the SEI to perform a review of and make recommendations for its Customer Accounts Data Engine.

“Rebooting the Refrigerator.” April 29, 2003. This widely syndicated article about the pervasiveness of software quotes Watts Humphrey.

“Virus Overwhelms Global Internet Systems.” January 25, 2003. This article about the Slammer worm mentions the CERT/CC and quotes the CERT/CC’s Marty Lindner.

### **Boston Globe**

“Making It Tough on Digital Thieves.” July 28, 2003. The CERT/CC’s Larry Rogers explains why always-on Internet connections are dangerous.

### **CIO Magazine**

“The Bugs Stop Here.” May 15, 2003. This cover story includes insights from SEI Director Steve Cross, SEI Fellow Watts Humphrey, SEI Program Director Linda Northrop, and CERT/CC Director Richard Pethia.

### **CNET**

“Program Focuses on Security Response.” July 14, 2003. The CERT/CC has developed a program to train and certify individuals in computer security incident handling. The CERT/CC’s Barbara Laswell says that the certification is “a benchmark that says that the leader knows how to lead and manage an incident response team.”

### **CNN**

“Internet Worm Spreading Rapidly.” August 13, 2003. The CERT/CC’s Marty Lindner says that, although the Blaster worm is a threat that users must take seriously, the Internet’s backbone has suffered little damage so far.

### **Computerworld**

“CERT to Lead Project to Promote Sharing of Security Information.” August 4, 2003. The CERT/CC will partner with ArcSight to help improve how organizations share information.

### **CSO Magazine**

“Peer to Peer.” September 2003. Clyde Chittister, the SEI’s chief operating officer, contributed to this article about the need for executive-level security.

“The Big Fix.” October 7, 2002. This article about software quality quotes SEI Director Steve Cross and mentions the SEI.

### **DCMilitary.com**

“CMM, TSP, PSP: A Winning Combination for NAVAIR Systems, Software.” April 10, 2003. The SEI’s Capability Maturity Model, Team Software Process, and Personal Software Process work together to provide optimal conditions for software development and maintenance.

### **eWeek**

“Turning Out Quality.” March 10, 2003. This article about creating secure and reliable software features Watts Humphrey, the SEI’s TSP and PSP technologies, Rich Pethia, and the CERT/CC.

### **New York Times**

“Spam-for-Money Plan Suspected by Expert on E-Mail Viruses.” August 25, 2003. Some computer security experts believe that the SoBig worm is an attempt to create software engines for sending spam. Whatever the motives of the worm’s author, CERT/CC Internet security analyst Brian King expects a new variant of the worm to appear soon.

“Fast Spreading Worm Attacks Microsoft Windows.” August 12, 2003. On August 12, a new worm—the Blaster worm—began to infect computers worldwide. The CERT/CC’s Marty Lindner told the *New York Times* that the number of computer users affected by the worm would be difficult to estimate.

### **Potomac Tech Journal**

“Capability Maturity Model Is Useful Tool.” October 14, 2002. This article is about applying the SEI’s CMM for software requirements definition and management.

### **Wall Street Journal**

“Viruses Are Wake-Up Call for Software Industry.” August 26, 2003. The recent Blaster and SoBig worms illustrate the poor state of software quality. The SEI’s Watts Humphrey says that greater discipline in software engineering would make software programs more secure against threats like Blaster and SoBig.

“Keeping Your PC Safe from the Blaster Worm.” August 14, 2003. Computer users must be more diligent in securing their PCs against the Blaster worm. Marty Lindner of the CERT/CC says that end users are responsible for defending against security threats.

*During an interview with the CERT/CC’s Marty Lindner, Riva Richmond noted that readers are expressing their thanks to her for publishing the Blaster worm recovery steps that the CERT/CC and public relations provided to her. One reader told her, “This is the best reason for continuing my subscription... for this type of information.” Riva Richmond writes for the Dow Jones News Service, a syndication company, and her work is published regularly in the Wall Street Journal.*



**SEI PARTNERS**

SEI 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 courses.

**CERT Coordination Center Courses**

Clark County, Nevada  
Internal Use Only

Electronic Commerce Universal, Inc.  
Taipei, Taiwan

ICSA.cl  
Santiago, Chile

Internet Security Solutions Taiwan  
Taipei, Taiwan

Presecure Consulting GmbH  
Telgte, Germany

**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

American Management Systems, Inc.  
Fairfax, VA

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

First Data Corporation  
Internal Use Only

Hilbing & Associates, Inc.  
Pittsburgh, PA

Institute for Software Process Improvement (ISPI)  
Hornbrook, CA

Integrated System Diagnostics, Inc.  
Tampa, FL

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 Courses**

2020 Company, LLC  
Internal Use Only

3Com  
Internal Use Only

A1 Independent Consulting  
Birmingham, AL

A B & I  
Internal Use Only

Advanced Information Services, Inc.  
Peoria, IL

Alcyonix, Inc.  
St-Bruno, Canada

Alexanna, LLC  
Pittsburgh, PA

American Management Systems, Inc.  
Fairfax, VA

Assess-IT, Inc.  
Marietta, GA

Automatic Data Processing (ADP)  
Internal Use Only

BAE Systems  
Internal Use Only

Marilyn Bush Associates  
Philadelphia, PA

The Boeing Company  
Internal Use Only

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

Center for Systems Management  
Herndon, VA

ChangeBridge, Inc.  
Chantilly, VA

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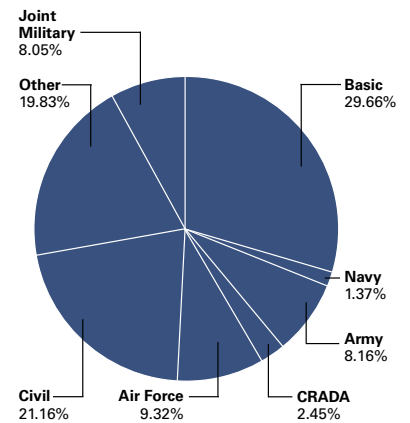
In FY 2003, the SEI worked with many organizations in the network, including

- U. S. Army Aviation and Missile Command (AMCOM)
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- Practical Software Measurement (PSM)
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- Tri-Services Assessment Initiative (TAI)

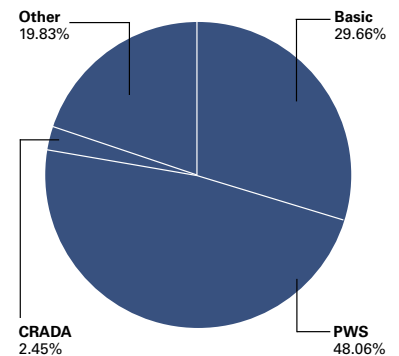
## FUNDING FOR FY 2003 AND SUPPORT FOR THE SEI'S DOD SPONSORS

The SEI received \$65.8 million in funding for FY 2003. The charts below show this funding arranged by funding organizations and 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.

### Funding by Organization



### Funding by Type



**ABBREVIATIONS,  
ACRONYMS, INITIALISMS****AADL** Architecture Analysis and Design Language**ABET** Accreditation Board for Engineering and Technology**ACM** Association for Computing Machinery**ACM SSRS** Association for Computing Machinery Workshop on Survivable and Self-Regenerative Systems**AEE** advanced engineering environment**AMCOM** U.S. Army Aviation and Missile Command**APCS** Assembly Process for COTS-Based Systems**API** application program interface**APL** Johns Hopkins Applied Physics Laboratory**ASERC** Alberta Software Engineering Research Consortium**ASP** Acquisition Support Program**ASP** application service provider**ASSIP** Army Strategic Software Improvement Program**ATAM** Architecture Tradeoff Analysis Method**ATD** advanced technology demonstration**BCS-F** Battle Control System Fixed**C4I** command, control, communications, computer, and intelligence**CBA** Capability Maturity Model-Based Appraisal**CBA-IP** Capability Maturity Model-Based Appraisal for Internal Process Improvement**CCS-C** Command and Control System Consolidated**CeBASE** Center for Empirically Based Software Engineering**CECOM** Communications-Electronics Command Software Engineering Center**CERT/AC** CERT Analysis Center**CERT/CC** CERT Coordination Center**CHI** computer-human interaction**CLIP** Common Link Integration Processing**CMM** Capability Maturity Model**CMMI** Capability Maturity Model Integration**COTS** commercial off the shelf**CRADA** cooperative research and development agreement**CRSIP** Computer Resources Support Improvement Program**CSCW** computer-supported cooperative work**CSIRT** computer security incident response team**CURE** COTS Usage Risk Evaluation**DACS** Data Analysis Center for Software**DAU** Defense Acquisition University**DISA** Defense Information Systems Agency**DJMPS** Defense Joint Military Pay System**DMCA** Digital Millennium Copyright Act**DoD** Department of Defense**ECSAP** Electronic Crime Special Agent Program**EDMS** Electronic Document Management Systems**EPIC** Evolutionary Process for Integrating COTS-Based Systems**ERP** enterprise resource planning**e-RA** Electronic Authentication Risk and Requirements Analysis**E-SEPG** European Software Engineering Process Group**EU** European Union**FASE** Fundamental Approaches of Software Engineering**FBCB2** Force XXI Battle Command Brigade and Below**FCS** Future Combat Systems**FFRDC** federally funded research and development center**FIRST** Forum of Incident Response and Security Teams**FOM** federation object model**FSQ** flow service quality**FSSE** Fire Support Software Engineering**GQIM** goal-question-indicator-metric**GMT** ground mobile terminal**GPS OCS** Global Position System Operational Control Segment**HB** handbook**HCI** human-computer interaction**HLA** high-level architecture**ICCBSS** International Conference on COTS-Based Software Systems**ICSE** International Conference on Software Engineering**ICSM** International Council on Software Maintenance**IDECS** Integrated Budget Documentation and Execution System**IEEE** Institute of Electrical and Electronics Engineers**IFIP** International Federation for Information Processing**INCOSE** International Council on Systems Engineering**IR&D** independent research and development**IRS** Internal Revenue Service**IRS CADE** Internal Revenue Service Customer Account Data Engine**ISAC** information sharing and analysis center**ISAM** Integrated Software Acquisition Metrics**ISIS** Integration of Software-Intensive Systems**ISO** International Organization for Standardization**IT** information technology**ITA** independent technical assessment**JNIC** Joint National Integration Center



<b>JSSA</b> Joint System Support Activity	<b>PSM</b> Practical Software Measurement	<b>SPICE</b> Software Process Improvement and Capability Determination
<b>JTRS</b> Joint Tactical Radio System	<b>PSP</b> Personal Software Process	<b>SPIN</b> Software Process Improvement Network
<b>JTT/ITS</b> Joint Targeting Toolkit/Interim Targeting Solution	<b>PWS</b> project work statement	<b>SPLC</b> Software Product Line Conference
<b>KJLC</b> Kurt J. Lesker Company	<b>QAAM</b> Quality Assurance Association of Maryland	<b>SPS</b> Standard Procurement System
<b>LSI</b> lead systems integrator	<b>QAW</b> Quality Attribute Workshop	<b>SR</b> special report
<b>MDWAR</b> Missile Defense Wargame and Analysis Resource	<b>R&amp;D</b> research and development	<b>STC</b> Software Technology Conference
<b>MES</b> manufacturing execution system	<b>RBNA RTC</b> Robert Bosch North America Research and Technology Center	<b>STSC</b> Software Technology Support Center
<b>MILPDS</b> Military Personnel Data System	<b>REFSQ</b> Requirements Engineering: Foundation for Software Quality	<b>STEP</b> Software Technology and Engineering Practice
<b>MIT</b> Massachusetts Institute of Technology	<b>RHAS</b> Requirements for High Assurance Systems	<b>STO</b> Science and Technology Objective
<b>MSSP</b> managed security service provider	<b>SA-CMM</b> Software Acquisition Capability Maturity Model	<b>SW-CMM</b> Capability Maturity Model for Software
<b>NASA</b> National Aeronautics and Space Administration	<b>SAE</b> Society of Automotive Engineers	<b>TAI</b> Tri-Services Assessment Initiative
<b>NAVAIR</b> Naval Air Systems Command	<b>SAT</b> Software Architecture Technology	<b>TAPO</b> Technology Applications Program Office
<b>NDIA</b> National Defense Industrial Association	<b>SCAMPI</b> Standard CMMI Appraisal Method for Process Improvement	<b>Tcl/Tk</b> Tool Control Language/Toolkit
<b>NIST</b> National Institute of Standards and Technology	<b>SCE</b> Software Capability Evaluation	<b>TCM</b> technology change management
<b>NPS</b> Naval Postgraduate School	<b>SEHAS</b> Software Engineering for High-Assurance Systems	<b>TCT</b> Time Critical Targeting Functionality
<b>NRO</b> National Reconnaissance Office	<b>SEI</b> Software Engineering Institute	<b>TDL</b> tactical data link
<b>NSSE</b> national special security event	<b>SEIR</b> Software Engineering Information Repository	<b>TIDE</b> Technology Insertion, Demonstration, and Evaluation
<b>NUWC</b> Naval Undersea Warfare Center	<b>SEPG</b> Software Engineering Process Group	<b>TN</b> technical note
<b>OAR</b> Options Analysis for Reengineering	<b>SEPG-LA</b> Software Engineering Process Group Latin America	<b>TR</b> technical report
<b>OCTAVE</b> Operationally Critical Threat, Asset, and Vulnerability Evaluation	<b>SEMA</b> Software Engineering Measurement and Analysis	<b>TRL</b> technology readiness level
<b>OCTAVE-S</b> OCTAVE for Small Businesses	<b>SESC</b> Software Engineering Standards Committee	<b>TSP</b> Team Software Process
<b>OOPSLA</b> Object-Oriented Programming, Systems, Languages, and Applications	<b>SIGSOFT</b> Association for Computing Machinery Special Interest Group on Software Engineering	<b>USAID</b> U.S. Agency for International Development
<b>OTS</b> off the shelf	<b>SIM</b> security improvement module	<b>USC</b> University of Southern California
<b>PAIS</b> Process Appraisal Information System	<b>SIP</b> strategic impact program	<b>USSS</b> United States Secret Service
<b>PACC</b> Predictable Assembly from Certifiable Components	<b>SISO</b> Simulation Interoperability Standards Organization	<b>XP</b> extreme programming
<b>PC</b> personal computer	<b>SMC</b> Space and Missile Systems Center	
<b>PCS</b> Performance-Critical Systems	<b>SME</b> small manufacturing enterprise	
<b>PECT</b> Prediction-Enabled Component Technology	<b>SPI</b> software process improvement	
<b>PLP</b> Product Line Practice		
<b>PLTP</b> Product Line Technical Probe		
<b>PMI</b> Project Management Institute		



## IN MEMORIAM



**Alan Christie**

Alan M. Christie, a senior member of the technical staff in the Networked Systems Survivability Program at the SEI, died March 29, 2003. He fought his cancer with great courage and strength all the way to the end.

Throughout his illness, Alan continued to work with the CERT Coordination Center at the SEI, contributing to the Easel Survivability Simulation project ([www.cert.org/easel/](http://www.cert.org/easel/)). He had also worked in software process, software technology transition, and software engineering technology at the SEI. Alan also served as a member of the SEI Library Committee for several years. Before joining the SEI, Alan worked in nuclear engineering and nuclear safety.

All who have known Alan throughout his years at the SEI will miss his scientific curiosity and ability, his wit, his pleasant personality, and his positive outlook.



**Suresh Konda**

Suresh Konda, winner of the 2002 SEI Angel Jordan Award for Innovation, died in May.

Suresh's most recent work centered on information security for large networks. His work has been widely recognized as the most advanced work in netflow analysis that has ever been done. Suresh used his background in statistics and scientific methodology to increase our ability to spot new network attacks and safeguard DoD networks.

Before coming to the SEI, Suresh taught classes in human resources, human resources information systems, human resources planning, research methods, and policy analysis and planning at Purdue University, where he was an assistant professor of management and public policy at the Krannert Graduate School of Management. He also taught at Carnegie Mellon University.

Those who knew Suresh will miss his insight, his exuberant personality, and his straightforward approach to life.

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