

Software

Q U A L I T Y

SOFTWARE PROCESS IMPROVEMENT— A SUCCESSFUL JOURNEY

BY DEEPTY B. CHAUHAN

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Introduction

The purpose of this paper is to communicate factors critical to successful, rapid progression up the ISO 9001 or CMM ladder. Development models like the Capability Maturity Model may not be as easy to apply as the random search for truth, but they help apply the discipline necessary to create complex software systems. This paper emphasizes that real process improvement is not easy, and anyone who believes otherwise has either never tried it or has never helped make an improvement of lasting significance. Learning better techniques and technologies is only the beginning—there are many human aspects to work through as you try to fund the improvements, sell all the players on them, and then follow up until the changes are institutionalized.

My organization aimed for ISO 9001 certification and then CMM level 2 and Level 3 assessment approximately one and one-half years ago and knew that it would be grilled thoroughly by the ISO auditors and CMM assessors. For many organizations like ours, the interim target of achieving ISO 9001 or CMM levels is a daunting task. Discipline is no fun. Organizations readily acknowledge that striving to address projects according to ISO 9001 or CMM guidelines requires the creation of new procedures. It is vital to the success of improvement efforts to realize that process change entails cultural change and it's human nature to resist change. Numerous social and technical

barriers must be overcome to effect lasting improvement.

For software process improvement we first need to know our strengths and weaknesses so that the management can scope the improvement effort. Only with this knowledge can we customize an infrastructure for process improvement. We have had previous success with plans tailored according to the Software Engineering Institute's CMM model. Our experience includes the formation of a Software Process Engineering Group, who know their roles, responsibilities, charters, and action plans. This helps us develop a charter and vision and to establish a clear match to organizational goals and objectives. One pivotal decision was not to reinvent the wheel, but seriously consider industry best practices.

Later we saw that process improvement always pays dividends for those with the discipline to do it right.

The Strategic Plan

A clear vision is essential to the success of process improvement project. Senior management in our case had the vision that "process is product" and was committed to sponsor and support improvement efforts. We were responsible for mobilizing people and resources to try and make it happen, but process improvement was a new endeavor for my group and everyone was unsure how to get started and get organized. My organization opted for strategic planning using

(cont. on p. 3)

CHAIR'S CORNER

BY LINDA WESTFALL

I just got back from the Software Division's great International Conference on Software Quality (11ICSQ). As a result of the events of September 11, most of the other ASQ divisions with conferences scheduled for October and November canceled or postponed them. However, the Software Division's leadership decided to proceed with 11ICSQ as planned and we are really glad we did. We contacted our scheduled speakers and almost all of them chose to participate. Our attendance was down a little this year but what we lacked in numbers, we more than made up for in enthusiasm. There was as much or more networking and sharing going on than I have seen at most of the previous conferences. I was really proud of our efforts and I personally want to thank everyone who participated to make 11ICSQ a great conference. On behalf of the Software Division, I would like to recognize and thank:

David Zubrow, 11ICSQ Conference chair

Theresa Hunt, Software Division program chair

Carolee Cosgrove, 11ICSQ Technical Committee co-chair

Rufus Turpin, 11ICSQ Technical Committee co-chair

Karen Bishop Stone, 11ICSQ tutorial chair

Beth Adams, 11ICSQ exhibits chair

Tom Griffin, 11ICSQ Web & proceedings chair

Hank Sobah, Pittsburgh Section liaison

Cas Welch, Pittsburgh Section liaison

I also want to thank all the people who reviewed papers, the volunteers from the ASQ Pittsburgh Section, ASQ headquarters staff, and our 11ICSQ speakers, tutorial presenters, moderators, and exhibitors. I would most especially like to thank our attendees.

What happened on September 11 has affected most of us in one way or another. Anna Allison was scheduled to give a tutorial at the 11ICSQ. But Anna was a passenger on American Airlines flight 11, the first of the two planes flown into the World Trade Center. During the introductory comments at 11ICSQ, we took a moment of silence to focus our thoughts and prayers on Anna, for all of the victims of this senseless act, and their families and friends.

Plans for next year's 12th International Conference on Software Quality (12ICSQ) conference in Ottawa, Ontario, Canada are already in the works. Larry Jones has volunteered as the 12ICSQ chair and his committee is already very busy. The 12ICSQ call for papers was distributed at 11ICSQ and can be found at www.icsq.org. If you are interested in participating as a speaker, presenting a tutorial, exhibiting or volunteering to help, visit this Web site to find additional information.

IN MEMORY OF ANNA S. W. ALLISON SEPT. 30, 1952-SEPT. 11, 2001

Anna Allison had been scheduled to give a tutorial at the 11th International Conference on Software Quality, and in the normal course of events, she would have been there, enjoying the conference, and sharing ideas and some laughs with us. But Sept. 11 was not a normal day, as we all know. It was a day of senseless tragedy that touched many lives. Anna was a passenger on American Airlines Flight 11, the first of the two planes flown into the World Trade Center. And so, Sept. 11 has touched our lives.



Below are thoughts shared by a few of Anna's friends and colleagues:

"Anna Allison always got to the heart of the problem. Whether that problem was metrics or hamburger buns (no buns, please!), Anna faced the issue straight on, and dealt with it. I loved her sense of humor, warm smile, and generosity of spirit. I will miss her terribly."

—Johanna Rothman

"I met Anna at a QAI conference in April and her energy and optimism were contagious. She joined a group of us for dinner at a local Orlando restaurant and we all laughed the entire evening. I, personally, will miss her smiling face, her zest for life, and her optimistic attitude. She was a shining star who was on her way to the top of the software quality and metrics field."

—Carol Dekkers

"Anna touched everyone around her in a really nice way. We are all going to miss her and feel the sadness for a long time."

—Don Bartley

"Farewell to the bright light that was Anna. She brought not only vision and creativity to the software quality profession, but the ever illusive clear and level-headed thinking. Anna was never a bystander in this life, she was an enthusiastic and accomplished doer. Whether in her profession or her many interests, she became the best she could be. A wonderful cook, birder, photographer, singer, writer, and dear friend. All done well and with zest. How I miss her!"

—Cathy Pawelczyk

"I had the privilege of working with Anna for about 6 months at a biotech company in Cambridge. In fact, it was Anna who convinced management at this company that they needed my help. What I remember most about Anna was her willingness to go out of her way to help someone, whether it had to do with her particular area of responsibility or not. If you brought her a problem, she would do whatever she could to help you solve it. Anna was not only a colleague but also a friend. We will all miss her."

—Steve Rakitin

"I met Anna shortly before she made consulting her career. Anna gave one of her first presentations at one of our Software Quality Group meetings and she became a regular. I enjoyed seeing Anna's confidence, energy, and enthusiasm

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SOFTWARE PROCESS

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total quality management's *Plan-Do-Check-Act* cycle. We developed a vision to use the best practices of software development teams and the 11 best practices were identified:

- Develop iteratively (incremental development life cycle)
- Use component-based architecture
- Visually model the product using the Unified Modeling Language (UML)
- Formal risk management
- Agreement on interfaces
- Formal inspections
- Metric-based scheduling and management
- Programwide visibility of progress vs. plan
- Defect tracking against quality targets
- Configuration management
- People-aware management accountability

In the planning model we tried to analyze current projects through rigorous reviews based on the requirements of ISO 9000 and CMM. Next, we conducted organizational Gap Analysis between the current state and the vision we were seeking. The ISO 9001 nonconformance reporting mechanism itself became the catalyst for developing tactical plans by providing the team leaders with the required control mechanism for project tracking and oversight.

The Project Mindset

Our organization tried to treat software process improvement like a development project. Senior management sponsored the creation of a corresponding project team, selected a project leader, and established a repository to store process documentation and other process artifacts. We followed these steps which define our project plan.

- Start by discovering and understanding current practice throughout the group.
- Find existing process documentation and talk to practitioners to understand how tasks are performed.
- Reconcile any differences between actual and documented processes.
- Document and review the newly characterized process.
- Iteratively and incrementally improve the process and ensure that the documentation is updated appropriately.

Project planning, software configuration management, software quality assurance, project tracking, and software tools usage were the key areas our organization concentrated on for process improvement. We tried to customize Rational Unified Process for our working environment. Automated tools were also used. We also ensured that the visibility of the project to upper management and the rest of the organization was comparable to that of other important projects.

Culture and Resistance

Process improvement affects more than just the processes used by practitioners to perform their work. Process change means *culture change*, replete with all the difficulties inherent in changing the perceptions, values, and normative behaviors of a community. Some of the forces that make such improvement efforts difficult are:

- Resistance to change (often due to a perceived threat of losing power, control, familiarity, or social status)
- The existing tolerance and readiness for change present within the current organizational climate
- Process change imposes a learning curve, which typically makes things appear to get worse before they get better.
- Improvement efforts consume time and resources, which many would prefer to spend on their particular development projects.

In my organization we tried to solve the above problem by bringing our improvements from the "local heroes." These people should be "all-stars in the family": respected members of the organization with proven track records as developers or managers. I think it is important to have the "local heroes" be part of the Software Process Engineering Group. Don't settle for less than the "real thing." This is another one of those times when senior and middle management support may be needed.

We documented our local technical procedures by choosing these local heroes to write the procedures using SEI-CMM key practices as guidelines. The software quality assurance team was the center of guidance and support for all the process improvement activities. The SQA was the primary authoritative body for conducting and organizing improvement efforts in the organization. The entire practitioner community was regularly informed of the status of improvement efforts. It is also desirable to solicit input and feedback on process improvement issues from the practitioner community. We chose one pilot project so that we could discuss and test how software process improvement really helps in the current scenario.

Benefits of Process Improvement

The clearest textbook definition of return on investment (ROI) is, as described by Lawrence Putnam, "Investing to improve [productivity] involves forgoing the use of those funds for other purposes. In time the payback from the future stream of gains from operations returns the capital invested." The ROI may not always be in dollars; quality and schedule issues as a return are nearly as important to the participants as are the cost issues. Our measurement set spanned the following eight categories of metrics: effort, process, productivity, progress, quality, schedule, stability, and staffing. We asked our research participants to indicate which metrics from our set they actually maintained and add to our list any additional metrics they maintained. We also solicited the starting and ending phase of the software lifecycle over which each metric was maintained. When we analyzed the participants' measurement data across maturity levels against the eight metric categories, each maturity level showed, on average, a consistent growth pattern. We also tried to relate any immeasurable benefits we experienced from their process improvement program. The benefit most frequently noted by the research participants concerned attitudinal changes. The morale and confidence of the developers improved significantly, and software development experienced increased attention and respect from organizations external to the software organization. Participants also attributed less overtime, less employ-

(cont. on p. 4)

SOFTWARE PROCESS

CONTINUED

ee turnover, improved competitive advantage, and increased cooperation between functional groups as benefits that resulted from process improvement initiatives.

Conclusion

Software process improvement is crucial as any organization attempts to take on and deliver larger projects. The lack of well-defined software processes can be very costly. Support from all staff, especially top management, is a prerequisite for any serious SPI initiative. As a great philosopher once said, "It won't happen overnight, but it will happen."

Many improvement efforts fail or falter during the initial phases of process improvement. My organization was successful at rapidly reaching ISO 9001 and CMM level 3 because it made a point of applying lessons learned by others. But this cannot be the end for process improvement in any organization. Our journey toward process improvement will always continue.

References

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Roger S. Pressman, *Software Engineering: A Practitioner's Approach*, 4th ed., McGraw-Hill, 1996.

Watts Humphrey, *Managing the Software Process*, Addison-Wesley, 1989.

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Deepty B. Chauhan earned his bachelor's degree in electronics engineering and post-graduate diploma in marketing management. He is employed with ST Microelectronics, Noida, India where he leads a group in Software Quality Assurance and Software Verification and Validation. He has a five years' experience in software quality and testing.

PROGRAMS CHAIR UPDATE

BY THERESA HUNT

The 11th International Conference on Software Quality (11ICSQ) was a big success thanks to Dave Zubrow, our 11ICSQ conference chair, and the entire Programs Committee who are mentioned in the Chair's Corner column. Kala Ranganathan and Eric Patel were tied for the 11ICSQ "Best Presentation" award so both will receive complimentary registrations to 12ICSQ.

Mark your calendars for 12ICSQ October 28-30, 2002, in Ottawa, Canada. Our conference chair for 12ICSQ is Larry Jones. Larry has already begun planning for 12ICSQ and the call for papers has been issued. If you would like to volunteer to help Larry he can be reached at: joneslf@magma.ca. Information about the conference and the draft call for papers is available at www.icsq.org.

Recently the Programs Committee has been discussing the possibility of moving the conference to the spring or summer months. If you have a suggestion or any comments about moving the conference time frame I would be interested in hearing those. Please send an e-mail to theresahunt@earthlink.net.

Please watch our Web site for some great pictures of 11ICSQ.

ANNA S. W. ALLISON

CONTINUED

grow with each presentation. Anna's next presentation was scheduled for March. Sadly, that will now be replaced by the Anna Allison Memorial Presentation."

—John Pustaver

"Anna was one of the few people I've met whom I wanted to collaborate with on professional development activities. Her dynamic personality and endless enthusiasm always inspired me. I decided to not cancel my plans to speak at 11ICSQ because I know she would have wanted me to participate."

—Eric Patel

"Anna Allison was my friend and my colleague. We laughed and cried together and she is sorely missed."

—Linda McInnis, Boston SPIN chair

"I found working with Anna to be such a positive experience. Her ability to find relevant, quality speakers was amazing. She took her role as program chair seriously, but was always cheerful and pleasant, even when faced with tight deadlines and speaker transportation difficulties. I knew she as a very special person, but never realized just how special until I had the sad task of notifying our SPIN membership of her demise."

—Jim Withall, Boston SPIN membership chair

How do I remember Anna?

I remember Anna for her determined eyes and curly auburn hair,

I remember Anna for her strong opinions (even when people didn't want to listen),

I remember Anna for her many whiteboard talks and the lines/arrows she drew with abandon,

I remember Anna for her fierce commitment to do the right thing,

I remember Anna for her passions—gardening, cooking, and wine,

I remember Anna for her schmoozes with me about our shared love of world travel,

I remember Anna for her telling me how to make paté de foie gras from scratch,

I remember Anna for her telling me how to roll puff pastry like Julia Child,

I remember Anna for her laugh and smile.

I will always remember Anna—our friendship and camaraderie. She will always remain with each of us. Peace.

—Tim Rosa

The Software Division is contributing to one or more of the organizations selected by Anna's family. For those who would like to make their own contribution, the organizations are:

Anna S. W. Allison Memorial
c/o Friends of the Library
Vinalhaven Public Library
P.O. Box 384
Vinalhaven, ME 04863

Anna S. W. Allison Memorial
AIDS Action Committee
131 Clarendon St., 5th floor
Boston, MA 02116

Anna S. W. Allison Children's Fund
c/o Pediatric Associates
1011 E. Jefferson St.
Charlottesville, VA 22902

ANOTHER GREAT CONFERENCE!



▲ Dave Walker, Carol Dekkers, and Larry Jones man the registration area.



▲ Top photo: Stephen P. Hans and Watts Humphrey have a networking moment.

Bottom photo: Division council members Theresa Hunt, Jayesh Dalal, and Tim Surratt mingle with attendees.



▲ The Wild Bunch

Top row, left to right: Beth Adams, Doug Hamilton, and Patricia McQuaid.

Bottom row: Karen Bishop-Stone, Tom McCabe, and Don Vossburg.

◀ ICSQ attendees hard at work!



12TH INTERNATIONAL CONFERENCE ON SOFTWARE QUALITY

October 28-30, 2002 • Ottawa, Canada

American Society for Quality

Software Division
www.asq-software.org

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Presented by the ASQ Software Division
www.asq-software.org
Hosted by ASQ Ottawa Valley Section 407
www.asgottawa.ca

If you're online, visit these sites for any updates to the following information: <http://www.asq-software.org> or <http://www.icsq.org>.

Technical Program. Technical papers and panels should be practitioner-oriented. They may be based on research of interest to practitioners or on experiences that relate to software quality. A complimentary admission to the two-day technical program is given for each technical paper or panel session selected by the committee for inclusion in the conference program.

Tutorial/Workshop Sessions are either half-day or full-day sessions that provide practical knowledge to participants. Workshops that promote the active participation of learners through problem solving, case studies, or other interactive learning methods will be favored. A complimentary admission to the two-day technical program is given for each tutorial selected by the committee for inclusion in the conference, in addition to other compensation that may be provided.

Submission Requirements

Technical Papers: A biography and paper abstract of 450-600 words is required by January 31, 2002. To allow for proper review against competing submissions, papers should be complete drafts of the final paper including the abstract of 450-600 words, not presentation slides. Complete drafts along with speaker biography and author information form will be accepted through March 25, 2002. Notification will be sent May 13, 2002. Final versions of accepted papers will be due May 31, 2002. Presentation slides will be due by August 1, 2002.

Proposal for a Panel: Send 1-2 pages describing the topic of the panel discussion along with panel speaker biographies and author information form by March 25, 2002.

Tutorials: A biography and tutorial abstract of 450-600 words is required by January 31, 2002. Send a sufficiently detailed summary (2-5 pages) describing the topic to be presented in the workshop, learning objectives, business need or challenge, solution or resolution, results/lessons learned, and the presentation methods used (i.e., lecture, case studies, group exercises) along with a speaker biography and author information form by March 25, 2002.

"Managing for Product and Service Quality: Practical Strategies and Methods for Innovation and Competitive Advantage"

Suggested Conference Topics

- Software Quality Management and Alignment to Business Strategies and Goals
- Software Processes and Requirements Management
- Program/Project Management
- Software Reviews, Inspection, Testing, Verification, and Validation
- Software Audits
- Software Engineering Processes and Practices
- Configuration Management
- Metrics, Measurement, and Their Links to Business Performance Metrics
- Software Quality Philosophies and Principles
- Organizational and Interpersonal Techniques, Problem-Solving Tools, and Processes
- Implications of Professional Conduct and Ethics
- ISO and Other Software Standards

Submissions for the Technical Program

Technical papers and panel proposals should be sent as MS Word compatible e-mail attachments to Rufus Turpin, 12ICSQ Technical Program chair, at info@carpedieminfo.ca. The guidelines and other forms are available at ICSQ.org. Style guidelines will apply to the final papers and need not be followed for draft submissions offered for consideration. Please submit your author information form and your full paper to info@carpedieminfo.ca before the deadline to ensure adequate time for Program Committee review and consideration.

Submissions for the Tutorial Program

Tutorial proposals should be sent to Karen Bishop-Stone at karen@testware-assoc.com before the deadline to ensure adequate time for Program Committee review and consideration.

Volunteers: To volunteer as a reviewer, session moderator, or other position, send an e-mail to Larry F. Jones, 12ICSQ conference chair, joneslf@magma.ca.

Exhibitors and Sponsors: To request information on 12ICSQ sponsor and exhibitor opportunities send an e-mail to Beth Adams, Exhibits & Sponsors chair, at badams@lwcc.com.

SOFTWARE QUALITY ENGINEERING QUIZ

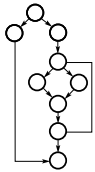
BY LINDA WESTFALL

Whether you are preparing for the Certified Software Quality Engineer (CSQE) examination or just testing your knowledge of Software Quality Engineering, why don't you sit back and let your brain do its thing. The answers can be found on p. 13 if you need a helping hand.

Note: The items in this quiz are NOT from the past CSQE examinations NOR were they created as part of the CSQE exam development process.

1. A software quality action team has just finished brainstorming a list of potential process improvement ideas. They have decided that these ideas need to be sorted and combined into categories. As their facilitator, which of the following tools would you suggest they use?
 - A. Cause and effect diagram
 - B. Activity network diagram
 - C. Matrix diagram
 - D. Affinity diagram
2. Which of the following is an example of a portability requirement?
 - A. The software shall operate in both UNIX and Windows environments.
 - B. The software shall include a mechanism for selecting either Celsius or Fahrenheit for use in reporting all temperatures.
 - C. The software shall monitor and report any memory utilization that exceeds 80% of the current memory capacity.
 - D. The software shall send an approval request e-mail to an employee's supervisor whenever an employee submits an inventory transmittal form.
3. A customer has requested an enhancement to an existing feature in a legacy software system. Because of poor configuration management practices in the past, the design and requirements for that feature cannot be found. The software engineer uses the source code to write the needed design and requirements documentation. This is an example of:
 - A. Reengineering
 - B. Reuse
 - C. Reverse engineering
 - D. Requirements elicitation
4. A work breakdown structure is a method for:
 - A. Subdividing a project into a hierarchy of subprojects, tasks, and subtasks.
 - B. Defining the individual steps in a set of work instructions for implementing a process.
 - C. Showing the sequential relationships between the various activities in a project.
 - D. Exploring the multiple causes of a malfunction in the flow of work in a system.

5. What is the Cyclomatic Complexity of the control flowchart at right?
 - A. 3
 - B. 4
 - C. 5
 - D. 6



6. Which of the following sets of test case input would result in decision coverage for the following piece of source code?
Premium = 400
If (Age <= 25) and (Sex = Male) then Premium = 1300
If (Age <= 21) and (Sex = Female) then Premium = 800
If (Age > 65) then Premium = 1000
 - I. Input: Age = 18 and Sex = Male
 - II. Input: Age = 21 and Sex = Female
 - III. Input: Age = 23 and Sex = Female
 - IV. Input: Age = 55 and Sex = Male
 - V. Input: Age = 75 and Sex = Female
 - VI. Input: Age = 68 and Sex = Male
 - A. I, II, and V only
 - B. I, III, and IV only
 - C. III, IV, and V only
 - D. II, IV, V, and VI only
7. Which of the following is NOT a role of the lead auditor?
 - A. Writing the final audit report
 - B. Preparing the audit plan
 - C. Conducting the closing meeting at the end of the on-site audit
 - D. Providing the authority to conduct the audit
8. One of the roles of a configuration control board is to:
 - A. Initiate change requests against the software
 - B. Evaluate the impacts of a requested change to the software
 - C. Debug the software to identify the changes needed to fix a failure
 - D. Prohibit changes from being made to baselined software

CRAWLING THROUGH THE WEB

BY SUE MCGRATH

We are continuing the project to update our Web presence. The first priority will be new functionality for ICSQ attendees, speakers, and committee members. One of the team members is looking into search engines to make our existing site more visible when you search for software quality information. We also have a small team looking at the issue of newsletters—online only or hard copy and online. And a new debate has come forward—should the page be made of frames? Our current page uses frames but some think we should move to something new. If you have suggestions on any aspect of our Web page—please send e-mail to me at suemcgrath@att.net. I hope to hear from many of you. There is a long list of items we would like to add to our Web page. If you would like to volunteer to be part of the Web team, please let me know. You will be able to learn about Web pages construction or share the expertise you already have. Happy crawling!



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TWO SEI RESOURCES FOR TRANSITIONING SOFTWARE ENGINEERING TECHNOLOGIES

BY ANITA CARLETON AND
LAUREN HEINZ
SOFTWARE ENGINEERING INSTITUTE
CARNEGIE MELLON UNIVERSITY

Editor's note: This article describes free, online resources available from the Software Engineering Institute that can be used to learn about a variety of software engineering practices. The information in these resources can be used to identify and evaluate an organization's practices and to learn what others have done and how well it worked. These resources can help you evaluate various practices and technologies and plan improvements for your organization.

The Software Engineering Institute (SEI) continually innovates ways to share and disseminate new ideas, lessons learned, expertise, and best practices in the areas of software engineering and software acquisition. The SEI has championed two Web-based resources for transitioning best software practices to government, academic, and industry audiences: the Software Technology Review (STR) and the Software Engineering Information Repository (SEIR). Both resources support the SEI's mission to transform software engineering from an ad hoc, labor-intensive activity to a managed, technology-supported engineering discipline.

The STR (www.sei.cmu.edu/str/) is an online resource that provides concise and current information about the strengths, weaknesses, limitations, and trends of emerging software technologies. Currently containing more than 60 technology descriptions, the STR offers managers and engineers a high-level summary of a software technology, an assessment of its maturity, usage considerations, costs and limitations, links to further information, and other valuable data. Unlike an online encyclopedia, the STR provides an up-to-date analysis of technology risk and provides questions managers should ask before deciding to use a particular technology. Renewed interest in the STR has kick-started efforts to develop additional content for the site. Technologists can participate by suggesting new topics and authoring technical descriptions, reviewing submissions, and updating existing descriptions.

The SEIR (<http://seir.sei.cmu.edu/>) is a forum for software engineers in the field from government, industry, and academia to exchange lessons learned, pose questions, and submit materials that might help others to adopt improvement approaches. The SEIR features a repository of information showing the impact of demonstrated software engineering improvement methods on organizational performance. The SEIR provides the practical information necessary to successfully transition new software processes, and provides it in a global software environment where other engineers with similar interests can be tapped for their expertise. It also contains an interactive version of the Community Maturity Profile that allows users to create profiles tailored along a variety of dimensions. The SEIR is free of charge,

but you must register to use it. The SEIR site has a public access area that shows what the SEIR has to offer. Since its launch in 1998 with a mere 104 users and minimal site content, the SEIR has grown to become one of the most highly visited areas of SEI-operated Web sites. The SEIR is now more than 12,000 members strong, with more than 12,800 Web pages, 365 documents, and 400 points to related information on the Web.

The success of the STR and SEIR depends on the involvement of the greater software engineering community. The SEI invites the members of the software engineering community to share their knowledge and expertise by contributing information to these resources. To get involved with the STR, please see www.sei.cmu.edu/str/feedback/ or contact team-str@sei.cmu.edu. For more information about contributing to the SEIR, please contact <http://seir.sei.cmu.edu/>.

STANDARDS CHAIR REPORT

BY SCOTT P. DUNCAN

ISO 9000-3 Progression

This document moved from a Working Draft (WD4) to an initial Committee Draft (CD1) with few substantial changes from the WD version. Most of ASQ's comments were accepted and are reflected in various bullet list entries.

Some technical problems that are easily fixed in the CD version include terms used that could lead one to assume this guideline document is a standard document, i.e., "shalls" and "wills" need to be removed because of this. Also, bullet numbering is inconsistent and sometimes erroneous, and bullet spacing seems to have been increased since the last draft, adding two pages to the length without any readability improvement. Since ISO charges by the page, this trivial issue would actually cost people several dollars per copy.

However, at a Working Group meeting in Moscow at the beginning of November, Japan and France raised serious issues about non-software-specific guidance in the document, lack of specific references to other SC7 documents (as opposed to just general reference to them), compatibility with ISO 15504, and appropriate reference to ISO 12207's coverage of various aspects of ISO 9001:2000.

IEEE Standards Proposed for SC7 Adoption

The IEEE will be "contributing" two standards for SC7 to adopt:

- IEEE 1220 on the application and management of the systems engineering process (which is in the current IEEE SESC standards collected four-volume set)
 - IEEE 1540 on risk management (which is new in the past year and not in the current collected four-volume set)
- To "contribute" a standard means one would lose formal control over progressing the standard. However, with IEEE folks involved in the SC7 group handling the documents, IEEE and ISO/IEC should be able to keep their individual versions in sync.

The Software Engineering Body of Knowledge (SWEBOK) document is in its "trial version" for the next couple of years, i.e., no major changes to be made. SC7 will likely adopt this as a

(cont. on p. 10)

STANDARDS CHAIR REPORT

CONTINUED

Type 3 technical report, i.e., one never intended to be other than a TR. In two years, IEEE will take all comments and issue another draft, trying to be considerate of all comments coming from the formal SC7 comment and voting process.

New Working Group (WG20) Proposed

Sweden has proposed a new working group to address a standard for software licensing that could, among other things, help guide development of tools to track adherence to licenses. Computer manufacturers and software companies should be interested in how this standard would impact international sales of licensed software.

ISO 15504 on Process Assessment

Parts 2 and 3 of the standard are being balloted as FCDs (Final Committee Drafts) which is the step just before balloting as a standard. However, at the International Plenary in Nagoya, Japan, in May, the convenor of WG10 proposed a change to the way the capability dimension is defined using language straight out of ISO 9001:2000. Apparently, the European Space Agency has an interest in making it easier to see how ISO audits could be related to ISO 15504 assessments.

There are objections to this, especially at this late date in the progression of the standard. If allowed, other things would have to change in the standard, perhaps even the scope of the assessment approach. The issue was to be decided in Moscow in early November at a Working Group 10 meeting. If the change were to be made, another FCD ballot on a new version of Part 2 would have to occur. (Official minutes/reports from this meeting have not been released at the time of this column being written. Some verbal reports suggested there may not have been necessary support to cause this change to be pursued.)

Parts 1 and 4 are about ready for the CD level. Part 5 is not yet at a working draft version, though it will likely be pushed through to CD as fast as possible since it lags behind the other parts.

FYI: Conformity and Compliance

ISO has some specific meanings for these two terms. In reading standards documents, one should be aware of what they imply, at least in ISO parlance. Conformity has to do with a product, service, or good meeting the provisions of a standard. Compliance has to do with another standard meeting the provisions of a standard. (For example, ISO 15504-2 talks about Process Reference Models complying with the requirements of ISO 15504 whereas Process Assessment Models conform to those requirements. Since the United States has taken the position (and it seems that it will be supported internationally) that a PRM would not necessarily have to be a public standard, hence, from ISO parlance perspectives, "compliance" might be too strict a term.)

As always, if you have questions/comments about standards, you can e-mail Scott Duncan at softqual@mindspring.com or call evenings and weekends at 706-565-9468, leaving a message at the same number during weekdays.

CERTIFICATION

BY DOUGLAS HAMILTON

I just returned from an excellent 11 ICSQ Conference in Pittsburgh. The topics and speakers were great!!! Even though attendance was down this year, we had twice as many people take the CSQE exam on Sunday, October 21, 2001, as took it last year at 10 ICSQ.

The new CSQE Body of Knowledge (BOK) will be used for the June 2002 exam administration. The BOK can be found on the ASQ Web site or in the new CSQE brochure that is available by calling ASQ Customer Service at 800-248-1946.

If you are interested in the CSQE exam, the schedule is:

Administration	Application Deadline
May 19, 2002	Mid-March (in Denver before the AQC)
June 1, 2002	April 5, 2002
December 7, 2002	October 4, 2002

If you are interested in information on the certification exam development process, visit the Web site: <http://www.asq.org/cert/signup/facts/> .

AN APPROACH TO HARMONIZING ISO 9001: 2000; AS9100: 2001; AND ISO 9000-3 FOR SOFTWARE

BY MICHAEL P. KRESS

Abstract

ISO 9000:2000 defines a strong focus on process, quality improvement, infrastructure, measurement, and the customer. Some will say that more is required in the 1994 version; others will say it is just "repackaging" of existing good practices expected of any ISO certified enterprise. Whatever your perspective, the impact on software development is frequently ignored. This report addresses the often-misunderstood impact of ISO on software development and, in particular, on aerospace software.

ISO IN THE SOFTWARE ENVIRONMENT

How many times have we visited an ISO certified facility, with its ISO banner or plaque proudly displayed in the lobby, only to find that the software maturity rating of the company is no better than SEI CMM level 1 or 2?

Why is this?

Most often it is because the ISO auditor/assessor has neither the expertise, nor the interest in evaluating the software environment. In theory, the software environment should be evaluated under Section 4, Design Control. But does it? By and large, it does not.

Most auditors say they do not focus on the software environment because it is not in the factory, implying that software production is not a quality assurance function per se, but rather an engineering function. Most fail to realize that software is a

HARMONIZING SOFTWARE

CONTINUED

product, just like a wing or body section, a landing gear, an autopilot, etc. Most think of software, especially in aerospace applications, as a "part of the product," not as a product itself. Somehow, the belief goes, the software gets inserted into the "real" product, which is then inspected and acceptance tested, and if it doesn't work, "...we'll catch it during the product acceptance testing."

For moderately complex to highly complex equipment, nothing could be further from the truth. Production acceptance testing is mostly a hardware integrity test, designed to assure that all the parts are in place, all solder joints are sound, no opens or shorts exist, that proper relay closure sequences are complied with, all gates toggle on and off correctly, and that the hardware will pass certain reliability tests designed to cull out infant part mortality.

The functionality of the software is not verified during hardware acceptance tests designed for ongoing production testing, but during a comprehensive suite of software life cycle tests and inspections culminating in First Article Inspection or equivalent. These include requirements, design and code inspections, module level tests, hardware/software integration tests, and system level tests. The vast number of failure possibilities that could occur because of different combinations of input conditions and

decisions is usually not completely testable. These failures occur because of missing or incomplete requirements definitions, missing or incompletely specified interfaces, logic or compilation errors, coding and syntax errors, nesting errors, rare or obscure combinations of input conditions, or "corner conditions," inspection and/or testing errors. While enterprises know and appreciate the value of hardware quality assurance, few from the hardware arena seem to realize the importance of software quality assurance to the software life cycle.

Software quality assurance (SQA) was given a credibility boost during the mid- to late '80s with the creation of the Software Engineering Institute's Capability Maturity Model. This model specified SQA as a "Key Process Area" needed for level 2 and beyond. Today newer models such as the CMMi and SPICE (ISO 15504) continue to postulate that SQA is a discipline integral to the software life cycle.

So given that presumption, how does ISO 9001:2000 (or the 1994 version) apply to the software environment?

Some have suggested that it be applied as is, without guidance. That somehow, the auditor should know what to look for in satisfying the objectives. Since software is product, it should have drawings, build instructions, change control, nonconforming material control, inspection, and tests. These folks feel that software can be audited using just ISO 9001 and a lot of imagination. History has proved this to be infeasible mostly because most ISO auditors tend to limit themselves to a hardware focus.

The authors of ISO 9001 prudently realized that software was sufficiently different from hardware to warrant its own guidance

(cont. on p. 12)

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HARMONIZING SOFTWARE

CONTINUED

document. Accordingly, ISO 9000-3:1997 was created as guidance for interpreting 9001 for software. The European TickIT initiative attempts to address this, but did not catch on in the United States because of significant opposition from major organizations that felt it went overboard, thereby creating a cottage industry for auditors without attendant value to the organization or the organization's suppliers.

ISO VS. AEROSPACE ISO

While ISO, (both hardware and software guidance) is quite good, the aerospace community found it lacked certain provisions. Accordingly AS9100:1999 was created by the American Aerospace Quality Group (AAQG) and eventually adopted by the International Aerospace Quality Group (IAQG). While ISO touches most of these areas, some of the areas of ISO needed enhancements for aerospace. A partial list of control elements includes:

- Identification of key characteristics
- Ready accessibility of QA procedures
- In-process verification points
- Decision criteria for phase transition
- Provision for customer and regulatory oversight
- Use of special process sources
- Control of digital data
- Control of subtier process sources
- Right of access to subtiers
- List of approved subcontractors
- Stronger traceability requirements
- First Article Inspection
- Approval of personnel for Material Review
- Statistical sampling rules
- Training for internal auditors
- Collection of in-service data

With the recent publication of AS9100: 2001, which is framed around ISO 9001:2000, there emerged a need for a revision to ISO 9000-3. ISO/IEC JTC1 SC7 WG 18 is creating this revision. It has currently completed the Working Draft stage and is at Committee Draft. It is forecast as availability sometime in mid-2002.

DELIVERABLE VS. NONDELIVERABLE SOFTWARE

The aerospace community makes a distinction between deliverable and nondeliverable software. While ISO is generally silent on this distinction, deliverable software generally needs a higher caliber of software to meet safety, mission performance, and maintenance objectives. (However, some safety focused software regulatory documents, such as RTCA/DO-178B, include ALL software that can affect operational safety, regardless of whether it is deliverable or not.) Accordingly the AAQG has created two working groups to address these two software sectors.

AAQG Project # 19 is addressing deliverable software. An international standard for software quality based on AS9100: 2001 interpreted for software, much like ISO 9000-3 is framed on ISO 9001, is envisioned. This includes product such as:

- Avionics & engine controls
- Flight controls, Displays
- Cabin temperature/pressure systems
- In-flight entertainment systems
- Weapons armament
- Mobile/ground-based defense systems
- Communication Navigation Surveillance/Air Traffic Management (CNS/ATM)
- Ground-based systems—simulators, trainers

AAQG Project # 020 is addressing non-deliverable software. While the direction here is not totally clear, it is currently intended to build on the draft of nondeliverable software created by an AIA/GAMA subcommittee. This includes,

- CAD sets & SW
- MFG SW
- Executive SW (OS)
- Test SW
- Inspection SW
- Data Acquisition SW
- Process Software

Michael P. Kress is an Associate Technical Fellow for the Boeing Commercial Airplane Group in Seattle. He is a Senior member of ASQ and chair-elect of its Software Division. He is a software process improvement facilitator and inter-divisional leader for common software quality standards across Boeing. He is the author of D1-9001, Advanced Quality System for Software Development and Maintenance, a supplier initiative dealing with an adaptation of the SEI-CMM for Boeing suppliers. Kress holds a BSEE, ASQ, CQE, and CSQE certifications, and is a registered professional engineer. He has over 25 years' experience in military and commercial avionics systems. He has served on numerous industry advisory and regulatory authority working groups, and is the QA representative to the Boeing Technical Fellowship Subcouncil.

ANSWERS TO THE SOFTWARE QUALITY ENGINEERING QUIZ

- Answer D is correct.** The purpose of the affinity diagram technique is to organize ideas into significant categories. The steps to constructing an affinity diagram include:
 - Writing each idea (or data item) on a piece of paper
 - Working in silence, the team then moves the items around and collects them into groups of similar items
 - After a few minutes have elapsed without additional changes, the team breaks the silence, holds a discussion of the results, and labels each category
- Answer A is correct.** Portability is a quality attribute describing requirements related to migrating the software to a different platform or environment (e.g., from UNIX to Windows).
- Answer C is correct.** Reverse engineering is the re-creation of the software design, interface information, and/or requirements from the source code.
- Answer A is correct.** A work breakdown structure is a method for subdividing a project into a hierarchy of subprojects, tasks, and subtasks. Process documentation/modeling defines the individual steps in a set of work instructions for implementing a process. Activity networks show the sequential relationships between the various activities in a project. Cause and effect diagrams (fishbone diagrams) explore the multiple causes of a malfunction in the flow of work in a system.
- Answer B is correct.** Cyclomatic complexity is calculated as edges—nodes + 2. There are 11 edges and 9 nodes in this control flow diagram ($11 - 9 + 2 = 4$).
- Answer A is correct.** Decision coverage requires that all possible choices be taken out of each decision. There are three possible true/false decisions in this piece of software:

Test Case	If (Age <= 25) and (Sex = Male)	If (Age <= 21) and (Sex = Female)	If (Age > 65)
I. Input: Age = 18 and Sex = Male	True	False	False
II. Input: Age = 21 and Sex = Female	False	True	False
III. Input: Age = 23 and Sex = Female	False	False	False
IV. Input: Age = 55 and Sex = Male	False	False	False
V. Input: Age = 75 and Sex = Female	False	False	True
VI. Input: Age = 68 and Sex = Male	False	False	True

The combination of test cases I, II, and V exercise both the True and False paths out of each of these three decisions and thus provide full decision coverage.

- Answer D is correct.** Providing the authority to conduct the audit is the role of the audit initiator (i.e., customer).
- Answer B is correct.** One of the roles of a configuration control board (CCB) is to evaluate the impacts of a requested change to the software. Based on this evaluation the CCB may decide to approve or disapprove the change or defer the change to a later version of the software. It is the role of the CCB to review and approve changes to baselined software, not to initiate or prohibit those changes. Typically, debugging

is the role of the owner of the work product (e.g., software would be debugged by the programmer, a document would be debugged by the author).

FROM THE REGIONS

BY MIKE KRESS

The last regional councilor teleconference was held Oct. 1, 2001. A member interest survey has been created and launched via the following link:

www-biz.aum.edu/tomgriffin/SoftwareQuality/RCSurvey.htm

It is intended to stimulate thought among SD members and to assist us, the leaders in planning events, workshops, presentations, literature, etc., that address those interests. Thus far we have had some feedback generating questions about some of the topics. We postulated a feedback period of approximately six months depending upon the rate of responses received. This is your opportunity as an RC to offer a service to your constituents that will enhance our ability to serve them. Our service must be driven by the interests and requests of our constituents. This is their opportunity to help us help them.



Region 1 by John Pustaver

Region 1 remembers Anna Allison, software quality consultant who was a passenger on American Airlines Flight 11 that crashed into the World Trade Center Sept. 11, 2001.

The kickoff meeting of the 8th season of the Software Quality Group of New England was held on Wednesday, Sept. 12, 2001. A moment of silence was observed for Anna Allison, her friends and family, and for all of those impacted by the tragic events of Sept. 11, 2001.

The Sept. 12 meeting was well attended and Jim Isaak gave a presentation on Web engineering. Of particular interest was information related to making Web pages accessible to the handicapped. A copy of Steve Rakitin's book *Software Verification and Validation* (contributed by Steve) was awarded in a drawing.

On Oct. 10, the Software Quality Group meeting featured Steve Rakitin speaking on "Writing Requirements." Steve presented a number of techniques for discovering ambiguity in written requirements. The meeting was very well attended and Steve awarded a copy of his book *Software Verification and Validation* in a drawing.

Information on meetings of the Software Quality Group of New England can be found on the Web at <http://www.swquality.com/users/pustaver/bcs.htm>.

Region 2 by Jean Burns

I want to recruit two deputy councilors in New York State. One RC is needed from the Manhattan/Long Island area and one from the Buffalo/Rochester area. Volunteers are encouraged to contact me as soon as possible about these positions.

Region 4 by Chris FitzGibbon

Chris FitzGibbon is the new regional councilor for Region 4. Chris is a co-founder and software quality consultant with Orion

(cont. on p. 15)

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FROM THE REGIONS

CONTINUED

Canada, an Ottawa-based consulting company that specializes in process improvement strategies and medical device quality standards for IT and the medical device organizations. Chris has performed extensive academic research on the value of quality standards to software project outcomes. He is the co-author of two books and has written several articles on the application of quality standards. Chris is an ASQ CQMgr, CQA, and CSQE, and has been an active participant in ASQ's Ottawa Valley Section since 1994. He is very pleased to be part of the Software Division Council and looks forward to meeting other division members. His report follows:

I am pleased and encouraged as I step into the role of regional councilor. There are many initiatives under way throughout Region 4, including preparations for the 12ICSQ to be held in Ottawa, Canada, in October 2002. The local team is forming with a focus on getting the support and involvement of the "Silicon Valley North" Hi Tech organizations as well as others from across Canada. Larry F. Jones (joneslf@magma.ca) is the 12ICSQ chair, and is also the ASQ Ottawa Valley Section chair.

Also in Ottawa, the monthly Software Process Improvement Network (SPIN) meetings began after a summer break. The fall schedule is available at www.spin.org. And, the Ottawa Software Quality Association (OSQA) recently held tutorials on Defect Causal Analysis, Practical Software Inspections, and Risk Management for OO Projects. Upcoming events are available at www.osqa.org.

Division members have also been active in Vancouver. An event earlier this summer included a panel discussion of knowledge management and the proposed IEEE Certified Software Engineering Professional (CSEP) designation. The discussion coincided with the beta release of the CSEP examination and included feedback on the associated Body of Knowledge and qualifications. This was the first in what is hoped to be many collaborations with IEEE Computing Society.

My goal as councilor is to encourage communication among division members and the sharing of best practices. In the upcoming quarter, I look forward to contacting Software Division members in each of the ASQ sections throughout Canada. I also encourage Software Division members to contact me regarding events in their area.

Region 6 by Tom Gilchrist

Region 6 now has a Web site specifically designed to allow ASQ Software Division members to see what is going on in their region. Point your browser to <http://www.luigirist.com/asq6> or go to the ASQ Software Division's Web site at asq-software.org and touch "officers" and scroll down to Region 6 and my name "Tom Gilchrist". However, I need content! If you live within the 10 states that make up the largest ASQ region, and you know about or participate in or are aware of quality activities, conferences, or meetings, please forward them to me. I'm looking for some "cub" reporters out there who just don't have enough to do already!

- The Pacific Northwest Quality Conference (pnsqc.org) held its 19th Annual Conference on October 15-17, 2001, at the Oregon Convention Center in Portland, OR. The ASQ Software Division and SASQAG have recognized this to be a good conference for those in the area not able to make the ASQ

Software Division conference. Note: The Region 6 mailing list was made available to this conference and ASQ is mentioned on the conference literature as a "co-sponsor" again this year.

- Workshops on Monday: both full- and half-day.
- Keynotes by Johanna Rothman and Shari Lawrence Pfleeger during the Tuesday and Wednesday conference.
- For further information see pnsqc.org or call Pacific Agenda at 503-223-8633.

- Again this year, SASQAG is supporting and the University of Washington Extension's Software Testing Certificate program. The course will be offered three times this fall and spring. 90 hours of evening classes are broken up into three courses:

- Software Quality Assurance and Process
- Software Quality Control and Process
- Test Design and Tracking

This evening program meets twice a week for three hours each night. The certificate program is designed for those who want to change their careers and get into testing and SQA and also for those who are already testers and want to learn about current methods, tools, and techniques. SASQAG supplies members to the advisory board and instructors.

- SASQAG is sponsoring a CSQE study group for this December's certification test for folks in the Seattle area. Currently there are five participants. This is the first time we have created such a study group and hope to increase the number of people sitting for the test as well as improve the percentage passing the exam. The group meets every other Saturday and uses the Quality Council of Indiana CSQE study materials starting Saturday, September 22, 2001. The SASQAG board has offered to pay up to \$75 of each person's study material costs if they sit for the exam. Again, the grant is being offered as a way to increase the numbers of people writing and passing the CSQE test.

- Of course, if you are in the Seattle area on the third Thursday of the month, make plans to attend the SASQAG public meeting at 6 p.m. (see sasqag.org for information...we don't meet in December). The program includes a guest speaker and a networking session that includes an ASQ Software Division table with literature on the organization, publications like the newsletter and the journal, and the CSQE certification program. Information and directions are at sasqag.org.

Remember, if you have information about quality events in Region 6, let me know.

Region 10 by David W. Walker

The Michigan Quality 2001 Conference was held in Livonia on Thursday, Oct. 11, at Madonna University. This event was a great success, drawing 65 attendees, half of which were not ASQ members. Each attendee received ASQ materials and a conference binder. Topics included "Software Quality Engineering ROI," "Software Quality at GM," "Automated Software Testing," "ISO 12207," "Process Getting in the Way of Process," and "CSQE." The facilities at Madonna were excellent and the university is easy to get to. Financial results for the conference were also excellent.

Special thanks to Nancy Poma (Detroit Section, deputy RC) and Tom Schoenfeldt (Detroit Section vice chair for Section Affairs) for their hard work pulling together this conference.

The RCs in Region 10 will be working on a unique opportunity to prepare and offer software quality engineering training in

(cont. on p. 16)

FROM THE REGIONS

CONTINUED

Michigan. Stay tuned for more details coming soon.

Region 11 by Greg Jones

Greg Jones is the new Region 11 councilor. Greg is a change consultant at Bank of America in Charlotte, specializing in software process improvement and the bank's Six Sigma Change Process. He was previously a QA manager at a Financial Information company, and a software engineer, requirements analyst, and business planner at a large public utility. Greg received a master's degree in computer science at North Carolina State University in 1998, and a bachelor's degree in nuclear engineering from Texas A&M University in 1985. He is certified as a software quality engineer and a quality improvement associate by ASQ, and is a software quality analyst by the Quality Assurance Institute. He is the founder and president of the Charlotte SPIN, past president of the Charlotte IT QA Association, and is a member of ASQ and the IEEE Computer Society. In his spare time, he teaches introductory computer courses at the local community college, and the occasional exam review class. Greg's report follows.

Key activities/events for the current quarter include identifying deputy regional councilors for Tennessee and Virginia. Volunteers are welcome to contact me. Also, I plan to initiate contact with local sections and associated groups (e.g., SPINs). My goal is to develop a regional communication network for software quality. I will be working on Charlotte/Raleigh local hookups to EDS seminar sponsored by Dallas SPIN. I plan on making connections at South Carolina ITEC trade show (local professional orgs sometimes attend these).

Region 14 by Jay Wilbur

Hello, I recently took on the job of regional councilor for Region 14. One thing I am very interested in doing is facilitating cooperative efforts throughout the region and sharing experience and expertise. If you are interested in building a communications network in our region and are willing to help, please e-mail me at jay.wilbur@dhs.state.tx.us.

Region 14—Dallas Area by Linda Westfall

The Dallas Section started its annual program this year with Mark Paulk speaking on the topic of "The History of CMMSM Development." Mark also wrote the feature article for the Dallas Section's newsletter, "Requirements for the Software CMMSM." Another software related article in the newsletter was "Software Standards: Forward Reconnaissance" by Theresa Hunt.

The Software Division was one of the sponsors of the Dallas Section mini-conference held October 8. One of the four tracks in this half-day conference was a software track featuring:

- * Software Process Improvement presented by Marcia Bernhardt
- * The "M" in "CM" Configuration Management: Managing Requirements to Eliminate "Causal Accuracy" and the Cost of "Intervention Resources" presented by Reginald Harvey
- * 12 Steps to Useful Software Metrics presented by Linda Westfall
- * Project Retrospectives presented by Susan Rudman & Bill Bartholomew

MEMBERS HELPING MEMBERS

Dear Members Helping Members,

We are (at long last) getting into more modern architecture, design, and implementation in some of our systems. (Yes, we do probably do the software your cell phone connects to as you roam about the United States.) We have pretty good data on inspection rates for C, C++, the whole set of languages that one has an engineer actually write.

However, as we get into using tools like Rational Rose, UML, etc., we now are inspecting artifacts where the "number of lines of code" are not the appropriate normalization factor. So I have a few questions:

1. What do people use for the units of measure for various OO constructs?
2. What kinds of inspection rates seem reasonable?

To put something on the table, we are probably looking at a bogey of factors/ hr for both review and prep rates when looking at stuff in Rational Rose RT. Note—the units have to be something the average engineer can assess for his or her code/design—function points "ain't" it!

I would appreciate any thoughts, experience, pointers, references, people with whom to talk, ...Clearly we are willing to share information, but right now we just don't have much.

Cordially,

Puzzled

P.S. We hope members with experiences on this problem will send their ideas to: tgriffin@monk.aum.edu.

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WANTED: A FEW GOOD CASE STUDIES FOR SIX SIGMA APPLICATIONS IN SOFTWARE

BY JEANNINE SIVIY

Software engineering's inventive and entrepreneurial spirit continues to soar. Numerous initiatives and methods, such as the Software Engineering Institute's Capability Maturity Model® (CMM®) and Practical Software & Systems Measurement (PSM), have been launched to improve software quality. And, in some companies, the timeline for quality improvement maturation has been compressed. Software has come face-to-face with Six Sigma while still tackling the basics of translating humanistic, intellectual practices into measurable, standard processes. Just as prototypes are often used to assist customers in visualizing new software products, concrete case studies are needed to bridge the gap between the current state of software quality and the "Six Sigma state."

Six Sigma is clearly raising the quality bar in manufacturing as well as its supporting engineering, service, and systems organizations. The software sector is being called to follow suit. The intensity of Six Sigma's customer focus and its high quality expectations should be viewed as advantageous, but Six Sigma also presents great implementation challenges. Informal data-gathering has shown the following to be among people's top concerns:

- Effective integration with software-specific initiatives
- Linkage of customer satisfaction measures to critical software processes and their measures
- Articulation of improvement efforts in terms of bottom-line dollars

While it is impossible to fully explore each of these challenges here, a few comments are warranted. Many people view Six Sigma as different from, but synergistic with, established software initiatives. Six Sigma can gain speed by using initiatives such as CMM and PSM to develop standard processes and measures. CMM and PSM can gain business effectiveness by using Six Sigma to select and prioritize improvement opportunities. This process begins with elicitation of customer requirements through methods including "Voice of the Customer" or "Quality Function Deployment." Then begins the arduous task of linking customer satisfaction measures with process development measures. It should be readily apparent that customers' interests include cost, schedule, use cases, and technical functionality. As one example of traceability to process development, it might be theorized that cost is a function of productivity, which is a function of defect density. Accordingly, reductions in defect density could be easily rolled up into a return on investment calculation. But, life is rarely this straightforward. Other factors influencing productivity might include software complexity, degree of reuse, and team experience (all of which may have a dependency on time).

Methods to navigate these complexities are taught in the Six Sigma curriculum; however, software examples to help people bridge the gap between the abstract and the concrete are lack-

ing. One way to improve training, and to generally advance the application of Six Sigma in software, is to document "prototypes" in the form of case studies. The ideal repository of case studies would have many views: project management, process development, product design, varying CMM levels, multiple other initiatives also in use, etc.

But, one step at a time: Initially, we need to seed a repository with a few public domain examples. If you are one of the vital few pioneers with a black belt project to share, please contact me at jmsiviy@sei.cmu.edu so that we can post the information on the SEI's Software Engineering Information Repository (SEIR, at <http://seir.sei.cmu.edu>). In parallel with this, we need to continually clarify and confirm the needs of the software community with respect to Six Sigma. Please begin checking the sources listed below for general information, examples, and opportunities for knowledge exchange. If you cannot find what you are seeking, please contact me as well.

For more information on Six Sigma:

An overview of Six Sigma is available in the SEI's Software Technology Review: <http://www.sei.cmu.edu/str/descriptions/sigma6.html>. FAQ's and reference presentations are available on the SEIR at <http://seir.sei.cmu.edu> (follow the link for "Measurement & Analysis" to reach Six Sigma).

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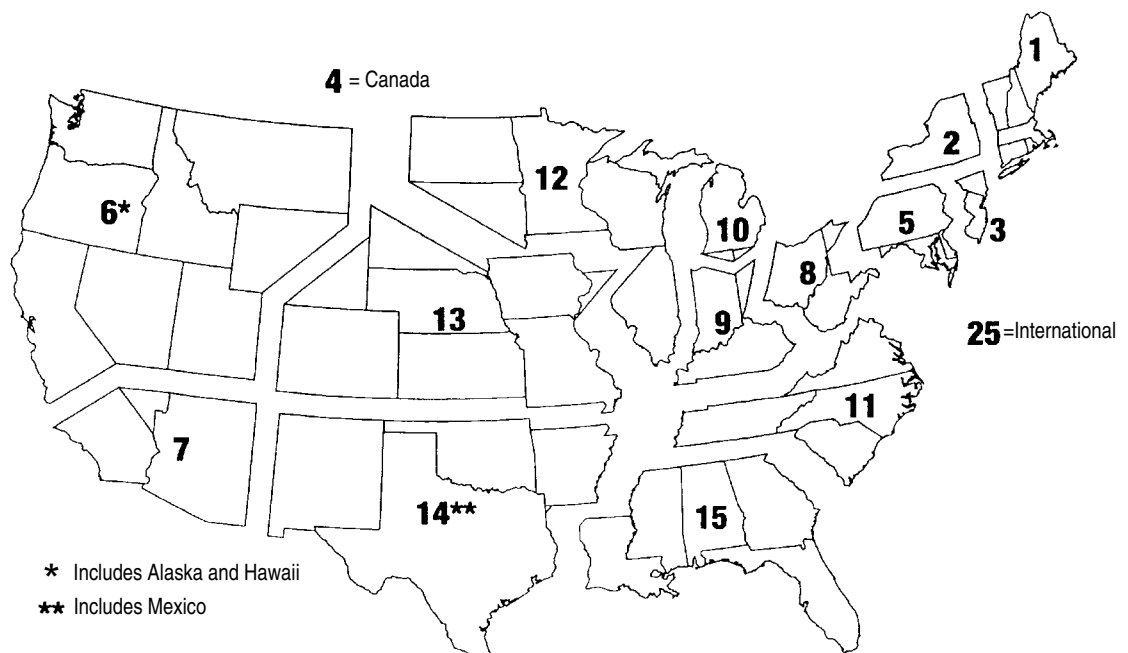
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