This article is part of the IEEE Reliability Society 2007 Annual Technology Report.

# Reliability Standards

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## 1. IEEE P1624

The latest IEEE-RS standard to complete working group draft development and enter the initial ballot process with the IEEE Standards Association (IEEE-SA) is P1624. P1624 is the Standard for Organizational Reliability Capability. The standard defines a method to assist designers in the selection of suppliers that includes assessment of the suppliers' capability to design and manufacture products meeting the customers' reliability requirements. The standard also provides a method to identify shortcomings in reliability programs, processes, practices or activities which can be rectified by subsequent improvement initiatives and corrective actions.

Coordination with the IEEE-SA, IEEE-RS, and the P1624 working group to start the initial standards balloting process began in February 2007. In June 2007, the project authorization request (PAR) changing the document from a guide to a standard was approved by the New Standards Committee (NesCom). The P1624 ballot pool was formed in July 2007. There are 106 IEEE-RS/ IEEE-SA members in the ballot pool. The initial ballot open for voting and comments from the ballot group on August 13, 2007, and the ballot closed on September 10, 2007. The ballot met the 75% returned ballot requirement with 83 votes received. The ballot met the 75% affirmation requirement with 69 votes in favor of the standard, 11 negative votes and 3 abstention votes.

There were 136 comments from the initial ballot. Based on the IEEE-SA process, all comments require official adjudication from the working group. All comments resolutions will be reviewed by the IEEE Standards Board. To prepare the comments resolution for the 136 ballot group comments, the working group met in October 2007. The University of Maryland's CALCE center hosted the meeting at College Park, Maryland, and the IEEE-RS handled meeting expenses.

The working group is planning to revise the draft in January 2008 and recirculate the draft in a second ballot (Recirculation Ballot #1 for 1624 Draft 2). The next meeting of the working group is in January during the RAMS 2008 conference. The working group and the Reliability Society are anxious to submit the final standards package to RevCom in October 2008 and publish P1624 in December 2008

One company is not waiting for the publication of P1624 to take advantage of the knowledge within its pages. The System Reliability Center (SRC), an Alion Science and Technology Center of Excellence, has developed a reliability maturity assessment process based on the material already published in various periodicals that preceeded P1624. This SRC process is developed for any organization desiring to make reliability a key product requirement. This process is a systematic approach that helps an organization determine the adequacy of their processes for designing and manufacturing for reliability. A proven evaluation method is provided as an independent reliability maturity assessment, which reviews the processes that design/manufacture reliability into a product, identifies shortcomings, and recommends improvements.

## 2. IEEE P1633

IEEE P1633 is a type of “standard” document called a “recommended practice”. IEEE P1633 promotes a systems approach to Software Reliability (SR) predictions and assessments. Software Reliability (SR) models have been evaluated and ranked for their applicability to various situations. Many improvements have been made in SR modeling and prediction since 1992. This Recommended Practice revision reflects those advances in SR since 1992, including modeling and prediction for distributed and network systems. The methodologies and tools included in this Recommended Practice are extended over the software life cycle (SLC).

Software Reliability Engineering (SRE) is an established discipline to help organizations improve the reliability of their software products and processes. The American Institute of Aeronautics and Astronautics (AIAA) defines SRE in the following terms: "the application of statistical techniques to data collected during system development and operation to specify, predict, estimate, and assess the reliability of software-based systems." IEEE P1633 is a composite of models and tools, which describes the "what and how" of software reliability engineering. An organization must have a disciplined approach to software development if it is to produce highly reliability software. The disciplined approach to software development should include all phases of the software life cycle and should take into account the risk to reliability due to requirements changes. A requirements change may induce ambiguity and uncertainty in the development process that may cause errors or faults. Subsequently, these errors or faults may propagate through later phases of development and maintenance. These errors or faults may result in significant risks associated with implementing the requirements. For example, reliability risk (i.e., risk of faults and failures induced by changes in requirements) may be incurred by deficiencies in the process (e.g., lack of precision in requirements).

The techniques and methodologies described in IEEE P1633 have been successfully applied to software projects by industry practitioners in order to do the following:

1. Assess software reliability risk.
2. Indicate whether a previously applied software process is likely to produce code which satisfies a given software reliability requirement.
3. Provide a measure for software design process improvement evaluation and software quality
4. Software reliability assessment procedures (i.e. measure current software reliability).
5. Data collection procedures to support software reliability estimation and prediction
6. Determine when to release a software system, or to stop testing the software and make improvements
7. Calculate the probability of occurrence of the next failure for a software system, and other reliability metrics.
8. Identify elements in a software system that are leading candidates for re-design to improve reliability.
9. Indicate software maintenance effort by assessing software reliability.
10. Assist software safety certification.

### Status Towards Publication

The 4th recirculation ballot for P1633 closed with a 94% approval rating. Three comments were received on the latest round of balloting, however; they did not result in changes to the draft since they were considered restatements of previous positions and had been addressed during the 3rd recirculation ballot.

P1633 was prepared for the RevCom meeting on December 5, 2007 with 1633 Draft 13 and ballot review package from 5 ballots. RevCom disapproved 1633 due to a single issue. Reason for the disapproval was the omission of comments resolution for 7 comments submitted by one ballot group member during the initial ballot. The working group has been requested by RevCom to run an additional recirculation ballot presenting the comments and comments' responses to the ballot group for their second review. 1633 Draft 14 was prepared for recirculation ballot 5. Comments resolutions from RevCom meeting were completed. IEEE P1633 will take 10 days to close this 5th recirculation ballot and be ready to submit to RevCom in January to prepare for next RevCom meeting in March. The working group and the Reliability Society are anxious to submit the final standards package to RevCom and publish P1633 in March 2008.

## 3. GEIA Reliability Standard Committee Meeting Trip Report

A meeting was held at the GEIA headquarters in Arlington, VA, on Oct 30-31 to call together folks from government and industry to develop a new reliability standard. The meeting was sponsored by the GEIA, G-47 Systems Engineering Committee. Lou Gullo attended the meeting representing Raytheon and IEEE Reliability Society.

The full list of attendees and their role or affiliation is shown:

Andy Long, Government Consultant
Bill Wessels, University of Alabama, Huntsville, contractor to Redstone Arsenal, US Army
Bruce Douty, Harris Corporation
Chris Denham, GEIA
Chris Sautter, University of Alabama, Huntsville, contractor to Redstone Arsenal, US Army
David Nicholls, Reliability Information Analysis Center (RIAC)
Dr Michael Cushing, ATEC, Aberdeen Proving Grounds, US Army
Dwayne Hardy, DoD OSD
Ernest Seglie, DoD OSD DOT&E
Gordon Tillery, SAIC, Consultant to OSD
James Ruma, General Dynamics, Land Systems
Judy Potter-Shields, RDECOM AMRDEC Redstone Arsenal, US Army
Lou Gullo, Raytheon IDS MMC
Ron Kramer, NAVSEA US Navy

Lou Gullo requested at the meeting to the GEIA representative to develop a joint GEIA/IEEE standard. He proposed revising the existing IEEE 1332 reliability program standard to align with the project planned by the GEIA, instead of creating a new standard The GEIA Standards VP refused the offer to work jointly with the IEEE and decided to develop a GEIA-only standard.

The GEIA established that the meeting attendees would become the initial Reliability Working Group. The GEIA Reliability Working Group meeting and the new standard, GEIA-STD-0009, was driven by the need of DoD to find a standard that defines what can be done to improve reliability of its systems and prevent occurrence of failure modes in the hands of the warfighter, and the inadequacy of current standards to set a direction to improve system reliability. Dr Ernest Seglie, DoD OSD DOT&E set the stage for the meetings. He plans to present a paper at RAMS to describe the effort of our working group. Dr Seglie and Dr Cushing's presentations at the GEIA meeting explained why the Government felt the need for the new reliability standard.

On Oct 30, the GEIA reliability standard working group began writing the draft for the new standard, GEIA-STD-0009. The GEIA Reliability Working Group began to draft the new

standard using the DoD RAM Guide (Primer), SAE JA1000 and IEEE 1332 as references. The working group completed drafts of the standard scope and purpose, and began an outline of the 4 main areas of the text.

4 teams were formed to work the following 4 objectives of the standard:

- requirements
- processes
- validation
- field FRACAS support throughout product/system life cycle.

One major topic of the meeting was to define a team concept for the development of a system or product and the overall reliability of the system or product. The standard establishes a relationship between the supplier and customer based on definitions as stated in EIA-632, which states that supplier and customer should be described as the "developer" or the "team". The supplier and the customer have joint responsibility to develop a reliability system or product. Standard EIA 632 was leveraged to use the term "developer" to refer to the customer and supplier. As described in GEIA-00009, the "developer" ensures the reliability, which means the customer-supplier development team shares the responsibilities for the reliability.

How much the team can use leveraged referenced text in IEEE-1332, SAE JA 1000 and 1000-1 and the DoD RAM Guide (Primer) is a big question. The working group did not want to leverage too much from the DoD Guide since the document describes processes too low in the details. GEIA cannot leverage too much from 1332 and JA1000 since these belong to other standards-generating organizations (IEEE and SAE, respectively) who own the copyrights.

The GEIA has established a website for the reliability working group. All documents from the meeting and those generated following the meeting are archived there. The GEIA reliability working group website is found at this URL:
http://www.geia.org/index.asp?bid=3095