

IEEE Standards Coordinating Committee 20:

Standards for System Test

A Report of the SCC20 Strategic Planning Working Group

Prepared for

SCC20 Steering Committee

Prepared by

Strategic Planning Work Group

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INTRODUCTION

According to the *IEEE Standards Companion*,

Standards exist because they help to build a basis in industry for development, commerce, and continuity of products. Having standards helps to create a universal market, a major concern in today's global economy. Standards offer a means of narrowing the variety of ways information is exchanged among different groups, allowing synergy between multi-company development efforts. Standards are also used for safety and to protect users and the environment (IEEE 1995).

The IEEE Standards Coordinating Committee 20 (SCC20), a committee of the IEEE Standards Board, has been vested with the responsibility of developing and maintaining standards for information and technology related to testing. With the adoption of the Abbreviated Test Language for All Systems (ATLAS™) in 1976 by the IEEE as IEEE Std 416, SCC20 was born. Since that time, eleven standards have been published, and currently, SCC20 is responsible for 16 standards projects, including ATLAS, Test Equipment Description Language (TEDL), Digital Test Interchange Format (DTIF), A Broad Based Environment for Test (ABBET), Artificial Intelligence Exchange and Service Tie to All Test Environments (AI-ESTATE), and the Standard for the Management of Test and Maintenance Information (TMIMS).

In 1995, the SCC20 Steering Committee established an *ad hoc* working group to examine the work of SCC20. This Strategic Planning Working Group (SPWG) was established “to provide a proposed strategic vision and a proposed strategic plan for the SCC20 (SCC20, 1995).” This document provides the proposed strategic vision and several recommendations for ensuring alignment of SCC20 with this vision.

OBJECTIVES

The objectives of the Strategic Planning Working Group and this report focus along four related paths concerning the efficiency and functionality of the SCC20 organization. Specifically, the objectives of the SPWG and this report are:

1. To establish the identity and common framework for the projects that reside within SCC20 and to provide an identity to the SCC20 as a whole within the structure of the IEEE.
2. To provide a baseline around which decisions can be made in the area of establishing liaisons, as well as managing and sponsoring test standardization projects.
3. To provide a framework for measuring the scope and completeness of SCC20 efforts in the area of system test standards. This includes, where applicable, identifying current projects that

- are out of scope and projects that have yet to be undertaken that are in scope. It also includes identifying projects elsewhere within the IEEE that need to be coordinated with SCC20 standards.
4. To provide an efficient management organization that ensures a quality, timely product with adequate review and oversight, while minimizing the administrative burden of the standards writing subcommittees.

PROBLEM

There are two aspects of the problem by the SPWG. The first aspect relates to SCC20 management, and the second relates to the technologies the standards support.

First, given the number of standards projects and published standards being maintained by SCC20, it is evident that careful management must occur to ensure appropriate utilization of resources to satisfy the objectives and requirements of these projects. Further, SCC20 must ensure a coordinated and consistent set of standards for the domain being undertaken. The SCC20 Steering Committee has been vested with the management and oversight of the SCC20 standards projects and is responsible for ensuring that standards within the scope of SCC20 are developed and maintained in a timely fashion in accordance with IEEE policy. Recently, issues related to establishing and executing standards projects have arisen, at times causing hindrance to progress by standards writing subcommittees and SCC20 as a whole. Many of these issues have been related to whether the projects are appropriate for SCC20 to sponsor. With no defined charter or vision, and with no direction from the IEEE, it was difficult to address the issues and decide on whether to approve the projects.

In addition to issues related to scope of SCC20 projects, issues in managing the standards projects have begun to surface. During SCC20 meetings, two standards writing subcommittees—ATLAS User’s Guide and TEDL—have typically had one working member each, and resources in two new standards writing subcommittees—AI-ESTATE and TMIMS—continue to be limited. While it is easier to establish consensus in small groups, standards need consensus from a broad constituency to maximize technical coverage and industry acceptance.

Second, over the years, SCC20 has expanded its task from the “ATLAS” committee to a committee coordinating a large number of test standards. SCC20 has had broad areas of participation over the past 25 years from members of industry, academia, and government. Further, the committee has been involved in several design related initiatives such as WAVES and VHDL, which have migrated back to the design community. This design relationship is a necessary part of the SCC20 function, but is not its main thrust.

SCC20 has also been involved in a series of initiatives related to its main thrust of test and diagnosis from a system perspective. At this time the SCC20 sponsors such varied standards projects as DTIF, ABBET, TMIMS, and AI-ESTATE while maintaining their original charter

with ATLAS and ATLAS-related standards such as TEDL. These standards have a number of things in common. For example, most are for testing electronic products above the chip level and for use after the design/manufacturing phase. All of the standards are applicable to this test domain. This level is characterized by complexity in the products to be tested and could be characterized as a system level approach for field support. This scope, however, must include design for test (DFT) methods; therefore, there must be a link to design information.

The boundaries between the various subdisciplines of product testing are not well defined. Testing approaches for design and manufacture may very well carry through to field maintenance. Further, gate level approaches such as digital fault dictionaries may be used at the board level, and boundary scan approaches may be extended to the system level. While it is not the intent of SCC20 to control or administer efforts in these areas, there is a strong need to coordinate and be compatible with initiatives such as these. Thus SCC20 is interested in direct liaison with such committees as STIL (IEEE-P1450) and the Module Test and Maintenance Bus (IEEE-P1149.5). In addition, the need to tie to standards for design information would mean that SCC20 should maintain and cultivate liaisons with EDIF, VHDL, and Verilog. There is also an increasing need to be part of the international standards efforts. Additionally, the coordination efforts at both the IEEE, US, and international levels should include the tight control of proliferating, overlapping, and redundant standards where possible.

Each of the standards committees inside and outside of SCC20 together with our surveys of individuals involved in SCC20 standardization efforts express a strong need to be based upon wide commercial support. This means, where possible, standards projects need to leverage off of *de facto* or consortium standards such as the VXI *Plug&Play* specifications. *De facto* standards are often linked to tools or products, and are standards by virtue of their wide-spread use rather than standards body action. For example, the requirements document for DTIF (IEEE P1445) states a strong preference for *de facto* standard candidates. This recasting of *de facto* standards as consensus body standards is a desirable trend, where the circumstances permit this to happen, and effectively removes the control of the *de facto* standard from a single company or group of companies. It also ensures that a consensus approach to future modifications will be followed, and thereby improve the emphasis on backward compatibility.

There are two basic approaches to standardization that SCC20 has undertaken, and it is important to recognize the differences in these areas. The first, represents a documenting of techniques that are currently in use in industry. Standards such as ATLAS, TEDL, AI-ESTATE, and DTIF fall into this category. These standards subcommittees have one or more models in the commercial sector as applications from which to work. Their job is synthesis, consensus, and extension. These standards have a user base in existence as they are developed.

The second approach represents a more fundamental leading of the commercial sector by advancing and defining the state-of-the-art. ABBET and TMIMS are examples where, currently, no clear consensus has evolved on how to proceed, and it is hoped that putting a standard set of procedures in place will promote basic approaches and solutions to test problems. This second approach to standardization requires greater marketing efforts, and these standards do not come with a ready constituency. ATLAS-2000 falls in between these two approaches. It leverages a

widely used approach (current ATLAS 716-1995), but it is introducing more state-of-the-art concepts. Until now, no one has used ATLAS 2000 approaches in test programming.

Finally, a philosophy has been evolving within SCC20 focusing on a tighter coupling of individual standards so that they play together in a coordinated fashion. Currently, ABBET, AI-ESTATE, ATLAS, and TMIMS are holding joint coordination meetings in an effort to more tightly couple their individual outputs. This is also reflected at the international level in ISO and IEC standardization efforts. SCC20 standards are currently being elevated to the international arena through the IEC. To promote this upward movement to the international level, strong coordination is needed with international standards bodies throughout the standards development process. This latter point is a strong element of the SCC20 vision—to provide a forum for the interchange of information about and coordination of test standards at the local, national, and international levels.

REVIEW OF THE DOMAIN

The initial effort of the SPWG was to survey the test domain to determine relevant areas of interest for the standards subcommittees. This review consisted of surveying several members of SCC20 to determine what these members believed were appropriate areas for SCC20 to be addressing. For this survey, the SPWG constructed a matrix of areas within the test domain and asked these members to rate the level of involvement SCC20 should have and the level of involvement SCC20 already provides.

The matrix is constructed such that the electronics domain and all other domains are two separate categories. Within each category, the matrix represents system level test, replaceable unit level test, and component level test. For each of these categories, there is design verification test, manufacturing and assembly test, factory acceptance test, maintenance test, and readiness test. Each category, is further subdivided into sub-categories. For the electronics category, there is digital, analog, hybrid, RF, and “other” types of electronic systems. For the non-electronic category, the matrix is further subdivided into mechanical, hydraulic, optical, pneumatic, and mixed technologies. The results for the electronics category are shown in Figure 1, and the results for the non-electronics category are shown in Figure 2.

In these figures, the letters indicate what the members of the SPWG believed to be currently covered by existing standards projects within SCC20. The shaded areas of the figures indicate the areas believed to be within the purview of SCC20. As represented by the data shown in Figure 1, it can be concluded that SCC20 should be covering the “higher-level” domains (i.e., system and replaceable unit level) of electronics testing and that SCC20 should focus on all aspects of automatic test at these levels. In addition, except for design verification and manufacturing test, component automatic testing is also within SCC20’s domain. Figure 2 also shows a focus on the higher levels, but this time excludes all aspects of design verification and manufacturing test. In addition, the focus is limited to manual and automatic test with no interest in self-test.

		System Level Test			Replaceable Unit Level Test			Component Level Test		
		Manual	Automatic	Self Test	Manual	Automatic	Self Test	Manual	Automatic	Self Test
Design Verification	Digital	de	de	e	de	de	e	e	e	e
	Analog	de	de	e	de	de	e	e	e	e
	Hybrid	de	de	e	de	de	e	e	e	e
	RF	de	de	e	de	de	e	e	e	e
	Other	de	de	e	de	de	e	e	e	e
Manufacturing and Assembly Test	Digital	de	de	e	de	de	e	e	e	e
	Analog	de	de	e	de	de	e	e	e	e
	Hybrid	de	de	e	de	de	e	e	e	e
	RF	de	de	e	de	de	e	e	e	e
	Other	de	de	e	de	de	e	e	e	e
Factory Acceptance Test	Digital	abde	abdeg	e	abde	abcdefg	e	de	cdef	ef
	Analog	abde	abdeg	e	abde	abdeg	e	de	de	e
	Hybrid	abde	abdeg	e	abde	abdeg	e	de	de	e
	RF	abde	abdeg	e	abde	abdeg	e	de	de	e
	Other	abde	abdeg	e	abde	abdeg	e	de	de	e
Maintenance Test	Digital	abde	abdeg	e	abde	abcdefg	e	de	cdef	ef
	Analog	abde	abdeg	e	abde	abdeg	e	de	de	e
	Hybrid	abde	abdeg	e	abde	abdeg	e	de	de	e
	RF	abde	abdeg	e	abde	abdeg	e	de	de	e
	Other	abde	abdeg	e	abde	abdeg	e	de	de	e
Readiness Test	Digital	abde	abdeg	e	abde	abcdefg	e	de	cdef	ef
	Analog	abde	abdeg	e	abde	abdeg	e	de	de	e
	Hybrid	abde	abdeg	e	abde	abdeg	e	de	de	e
	RF	abde	abdeg	e	abde	abdeg	e	de	de	e
	Other	abde	abdeg	e	abde	abdeg	e	de	de	e

a-716 b-993 c-1029 d-1226 e-1232,1389 f-1445 g-1446

Electronic Testing Context

Figure 1. Domain Review Survey—Electronics

Non-Electronic Testing Context										
		System Level Test			Replaceable Unit Level Test			Component Level Test		
		Manual	Automatic	Self Test	Manual	Automatic	Self Test	Manual	Automatic	Self Test
Design Verification	Mechanical	de	de	e	de	de	e	e	e	e
	Hydraulic	de	de	e	de	de	e	e	e	e
	Optical	de	de	e	de	de	e	e	e	e
	Pneumatic	de	de	e	de	de	e	e	e	e
	Mixed Tech	de	de	e	de	de	e	e	e	e
Manufacturing and Assembly Test	Mechanical	de	de	e	de	de	e	e	e	e
	Hydraulic	de	de	e	de	de	e	e	e	e
	Optical	de	de	e	de	de	e	e	e	e
	Pneumatic	de	de	e	de	de	e	e	e	e
	Mixed Tech	de	de	e	de	de	e	e	e	e
Factory Acceptance Test	Mechanical	ade	adeg	e	ade	adeg	e	de	de	e
	Hydraulic	ade	adeg	e	ade	adeg	e	de	de	e
	Optical	ade	adeg	e	ade	adeg	e	de	de	e
	Pneumatic	ade	adeg	e	ade	adeg	e	de	de	e
	Mixed Tech	ade	adeg	e	ade	adeg	e	de	de	e
Maintenance Test	Mechanical	ade	adeg	e	ade	adeg	e	de	de	e
	Hydraulic	ade	adeg	e	ade	adeg	e	de	de	e
	Optical	ade	adeg	e	ade	adeg	e	de	de	e
	Pneumatic	ade	adeg	e	ade	adeg	e	de	de	e
	Mixed Tech	ade	adeg	e	ade	adeg	e	de	de	e
Readiness Test	Mechanical	ade	adeg	e	ade	adeg	e	de	de	e
	Hydraulic	ade	adeg	e	ade	adeg	e	de	de	e
	Optical	ade	adeg	e	ade	adeg	e	de	de	e
	Pneumatic	ade	adeg	e	ade	adeg	e	de	de	e
	Mixed Tech	ade	adeg	e	ade	adeg	e	de	de	e

a-716 b-993 c-1029 d-1226 e-1232,1389 f-1445 g-1446

Figure 2. Domain Review Survey—Non-Electronics.

The results shown in the matrices indicate that the current set of standards within SCC20 seem overall to support the domains of interest (even though there are many specific deficiencies). Three standards projects appear to provide very broad coverage throughout the matrix, even of areas outside of their “intended scope”—P1226 ABBET, P1232 AI-ESTATE, and P1389 TMIMS. ABBET is attempting to develop a broad based environment for test, independent of any specific domain or test technology. AI-ESTATE has taken a technology-independent approach, focusing on diagnostics, and has developed a family of standards that can be applied to all of these areas. TMIMS is concerned with capturing and using test and maintenance data across system life-cycles and in all contexts.

The matrices also indicate that the members of SCC20 no longer believe we are limited to providing standards solely for automatic test, related to the ATLAS language. The areas of interest and expertise relate to all levels of testing above the component level, and to all types of testing beyond manufacturing and assembly test.

VISION

To assist in clarifying the role of SCC20 in the test standards domain, the members of the SPWG began by providing a “vision statement” for SCC20. Specifically,

IEEE SCC20 is the IEEE’s center of technical excellence for system¹ level approaches for test and diagnosis of both hardware and software. SCC20 provides a coordinated set of standards that are state-of-the-art, commercially derived, tightly coupled within the system test domain, and leverages the work of other committees including the design automation community and several technical committees of the IEEE Computer Society, IEEE Aerospace and Electronics Society, and IEEE Instrument and Measurement Society

This vision of the SCC20 was derived from subcommittee activities and from interviews with standards writers as well as surveys conducted by the SCC20 SPWG members.

IMPLEMENTATION STRATEGY

Based on the stated vision of SCC20 and the desire to focus on coordination and development of test standards at the system level, the members of the SPWG identified several characteristics under which one might reasonably expect SCC20 to operate. Some of these characteristics include the following:

¹ *System* may be defined as an aggregation of related elements that together form an entity of sufficient complexity for which it is impractical to treat all of the elements at the lowest level of detail.

1. The domain for SCC20 is the development of standards related to System Test which include test standards that apply to hardware, software, and systems above the chip and board levels.
2. The administration of SCC20 by the Steering Committee can be simplified and streamlined requiring less than the present 40–50% of the total SCC20 membership.
3. The effectiveness and well being of SCC20 requires a certain critical mass to ensure an adequate work force to develop and maintain the standards within the SCC20 domain. Thus part of the efforts of SCC20 must include strategic planning and proactive efforts to maintain and expand the SCC20 membership.
4. The subcommittees of SCC20 should represent test system functional areas rather than specific standards projects with overlapping interests.

Given the above, the following approaches for emphasizing and facilitating SCC20's role as the System Test Standards committee of the IEEE are provided.

SCC20 Domain

When ATLAS was the only standard for which SCC20 was responsible, SCC20 became known as the ATLAS Committee. This simple label was a means for self advertising the actions and interests of SCC20. Today, SCC20 is responsible for seven subcommittees and eight sets of standards. The term "ATLAS Committee" has been replaced fully by the less descriptive term, "IEEE Standards Coordinating Committee 20." This committee name does not serve to attract the interest or attention of persons who might be interested in the work of SCC20.

It is recommended that for all SCC20 literature, such as the documents distributed at AUTOTESTCON and ITC, we adopt a descriptive name such as "The System Test Standards Committee." This name describes the work of the committee and could play a role in attracting people who are interested in test at the system level. The name can also help clarify the assignment of standards work within the IEEE to the SCC20.

There are several areas for standardization within the SCC20 domain that currently are not being addressed. These areas include requirements for several standards that do not presently exist. These include test requirements documentation, testability program planning, and testability metrics. These areas and requirements are planned to be discussed in detail, in an upcoming *Strategic Plan* that the members of SPWG recommend be prepared by the SPWG as its next task.

Functional Alignment

Currently, the subcommittees of SCC20 are organized by specific standards projects being managed. In fact, the agenda of Steering and Plenary meetings are organized according to project number, which happens to align directly with the subcommittee. Unfortunately, overlap and duplication of effort exists between subcommittees (e.g., P716 and P1446). The subcommittees of SCC20 should be organized according to functional areas of test to facilitate efficient communication and development of relevant standards.

It is recommend that the number of existing subcommittees be reduced to gather like disciplines under a central functional focus. Some initial natural combinations, such as the following, suggest themselves.

1. *Test Description*: One subcommittee should encompass P716, P771, P993, and P1446. This subcommittee would handle additional language and binding standards for test descriptions.
2. *Test Application*: One subcommittee should encompass P1029 and P1445 (as it currently does). The realignment of the 1029 standard with the design community is still within the purview of this committee for liaison and coordination. Further, future projects concerning self-test, BIT, and internal test synthesis at the system level would be handled by this committee.
3. *Diagnostic and Maintenance Control*: One subcommittee should encompass P1232 and P1389. Integration of design for test and testability would be handled by this subcommittee. Alternatively P1389 could become part of test information integration.
4. *Test Information Integration*: One subcommittee should encompass P1226 (as it currently does). The overall architecture of system level test information would be handled by this subcommittee, including the tie to *de facto*, consortium, and international standards.

In summary, the current work of SCC20 could be more efficiently addressed at the administrative level under four major technical subcommittees, e.g., *test description*, *test implementation*, *diagnostic and maintenance control*, and *test information integration*.

Administration of SCC20

At present, there are 32 available seats on the SCC20 Steering Committee; not all of these seats are currently occupied. Recent records show a typical attendance to an SCC20 meeting ranging from 65 to 80 people, with a potential of between 40% and 50% of the attendees involved in the administration and management of SCC20 (i.e., being members of the Steering Committee).

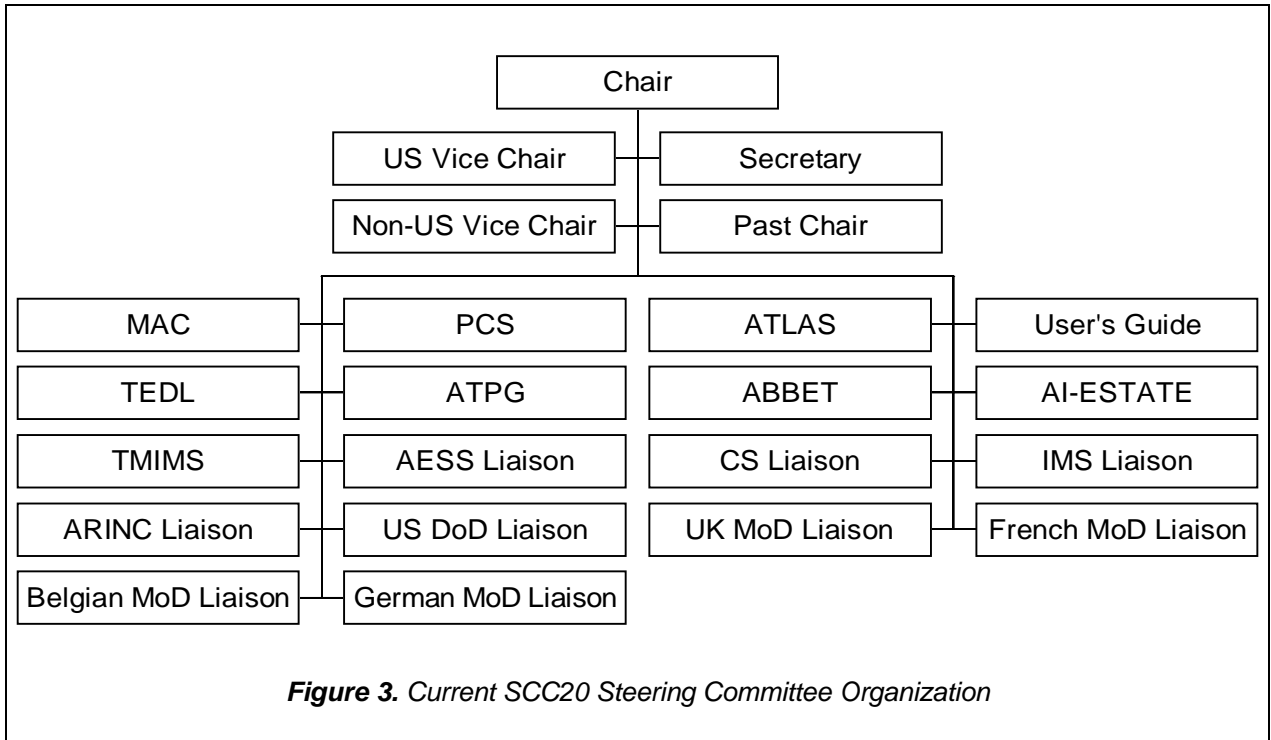
The membership of Steering can be divided into four categories. The first category is the SCC20 leadership in the form of the SCC20 Chair, the US and European Vice Chairs, and the Secretary. In addition, a seat is reserved for the past chair of SCC20. This category has five seats. In the second category are the administrators. This includes the co-Chairs of the Procedures and Coordinating Subcommittee and the co-Chairs of the Meeting Arrangements Subcommittee. This category has four seats. In the third category are the SCC20 standards managers. These are the co-Chairs of the standards-writing subcommittees of SCC20 who manage the standards being developed by SCC20. Currently, SCC20 has seven standards-writing subcommittees. This category has 14 seats. Finally there are the liaison members to SCC20 representing organizations with which SCC20 has a special relationship and which have particular interest in the standards developed by SCC20. Currently, there are nine liaison member seats on Steering.

It is desirable to reduce the size of the Steering Committee since too large of an administrative body degrades the efficiency of administration. At the same time, in developing a plan to reduce the size of the Steering Committee, we must ensure that no loss of critical guidance and functionality results from the downsizing. Since it is apparent that all four functional categories are required, it is recommended that these categories should continue to be represented on Steering. It is also recommended that the size of Steering be reduced as described in the next section.

Organization of SCC20

Currently, the SCC20 Steering Committee reflects the organization of SCC20 and is organized around seven standards-developing subcommittees (Figure 3). Specifically, the SCC20 Steering Committee is organized as follows:

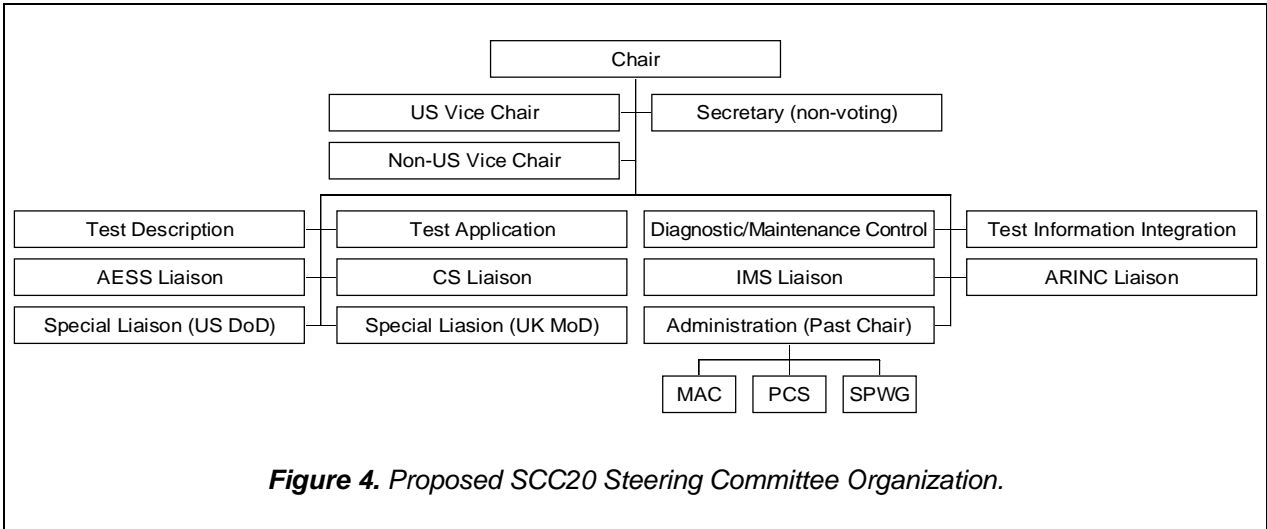
- Leadership
 - Chair
 - US Vice Chair
 - Non-US Vice Chair
 - Secretary
 - Past Chair
- Administrative
 - Co-chairs of MAC
 - Co-chairs of PCS
- Standards Managers
 - Co-chairs of ATLAS
 - Co-chairs of ATLAS User's Guide
 - Co-chairs of TEDL
 - Co-chairs of ATPG
 - Co-chairs of ABBET
 - Co-chairs of AI-ESTATE
 - Co-chairs of TMIMS
- Liaisons
 - Aerospace Electronics Systems Society
 - Computer Society
 - Instrumentation and Measurement Society
 - ARINC



- US DoD
- UK MoD
- French MoD
- Belgian MoD
- German MoD

As outlined earlier, there are 31 votes on SCC20 Steering (not counting the chair) and between 60 and 80 people regularly attending SCC20. Thus, approximately 50% of the membership can be involved in the managing of the standard committee. This is considered excessive and should be brought under control. To that end, the members of SPWG suggest the following re-organization of SCC20 and the Steering Committee. First, it is recommended that all members of the Steering Committee (with the exception of the chair) be urged to become *active* members of at least one standards writing subcommittee. Given this, the following new organizational structure of the Steering Committee (Figure 4) is recommended.

- Leadership
 - Chair
 - US Vice Chair
 - Non-US Vice Chair



- Secretary (non-voting)
- Administrative Subcommittee
 - Consists of working groups corresponding to MAC, PCS, and SPWG. Chaired by the Past Chair. In the absence of a past chair, the current chair of SCC20 would appoint someone to fill this position.
- Standards Managers
 - Presiding chair of Test Description (encompassing ATLAS, ATLAS User’s Guide, TEDL, and AdaTPD)
 - Presiding chair of Test Application (encompassing DTIF and other ATPG standards)
 - Presiding chair of Diagnostic and Maintenance Control (encompassing AI-ESTATE and TMIMS)
 - Presiding chair of Test Information Integration (encompassing ABBET)
- Liaisons
 - Aerospace Electronic Systems Society
 - Computer Society
 - Instrumentation and Measurement Society
 - ARINC
 - Special liaisons (re-affirmed every two years). Currently, this would be limited to the US DoD and the UK MoD.

Under this revised organization, only 13 votes exist on the Steering Committee (not counting the chair). A concern about balance notes that six of the votes are vested in liaisons while seven are vested in administrative and standards developing personnel. Under the current organization, only

nine of the 32 votes are vested in liaisons. This need not be a concern, however, since all of the liaisons are also active members of standards-writing subcommittees. In addition, four of these liaisons (i.e., AESS, CS, IMS, and ARINC) represent the formal “sponsors” of SCC20 and provide the required oversight from these sponsoring bodies. Finally, with seven votes, non-liaison voting members still possess “majority control” of the Steering Committee.

Another impact of this re-organization is that only four standards writing subcommittees will exist in the “new SCC20” (as opposed to the seven that exist today). Such a reduction in the number of subcommittees will tend to focus resources in the areas they are needed most and to reduce the number of single member subcommittees that seem to arise when standards are nearing completion.

Strategic Planning

The members of the SPWG feel that relying upon serendipity to ensure the critical mass needed for SCC20 is an inadequate approach to maintain the health and vitality of this standards body. Rather, proactive methods of informing user communities and recruiting committee members are required. To that end, the SPWG should be made a permanent part of the administrative subcommittee of SCC20 and should work closely with MAC and PCS to develop methods for informing and attracting interested users, and to plan for controlled and healthy growth of SCC20 within its intended domain. The SPWG, in conjunction with these other subcommittees, would be expected to present plans, strategies, approaches and methods to Steering on a regular basis concerning areas of technology to which SCC20 should apply its efforts and means for maintaining and expanding attendance.

RECOMMENDATIONS

Given the previous discussion, the following recommendations are made:

1. Based on previous approval by the SCC20 Steering Committee, it is recommended that approval be sought from the IEEE Standards Board to modify the name used in conjunction with IEEE SCC20. Specifically, the name should no longer be “The ATLAS Committee” but should be “The System Test Standards Committee.” This name should be used on all correspondence and with all publications to emphasize the expanded scope undertaken in the SCC20 standards projects.
2. It is recommended that, consistent with its name, the IEEE SCC20 should continue to focus on standards of concern to problems in system test. These standards should address issues in automatic, semi-automatic, and manual testing. These standards also should address issues in board, module, subsystem, and system test.
3. While it is recognized some of the standards currently under development within SCC20 have broad applicability beyond electronics testing, it is recommended that standards projects within SCC20 be limited, primarily, to electronics testing, including digital, analog, RF, electro-optical, and other related areas of testing.

4. To date, most of the standards developed by SCC20 have focused on issues of test programming and test documentation. It is recommended that documentation, software, *and* hardware standards related to system testing be addressed within SCC20 projects.
5. Given the expanded scope of SCC20, it is recommended that SCC20 investigate the feasibility of additional standards projects such as those related to test requirements documentation, testability assessment metrics, testability program planning, built-in test architectures, and test program generation for analog systems and multi-chip modules.
6. It is recommended that the organization of SCC20 and its Steering Committee be aligned along functional areas rather than standards projects. Specifically, we recommend SCC20 be organized with four standards writing subcommittees corresponding to *test description*, *test application*, *diagnostic and maintenance control*, and *test information integration*.
7. It is recommended that the SCC20 Steering Committee be reorganized to consist of four categories of members: leadership, administrative, standards writing, and liaison.
8. It is recommended that Steering leadership have three voting members (chair, US vice-chair, and non-US vice-chair) and one non-voting member (secretary).
9. It is recommended that Steering administration consist of a single administrative subcommittee with three working groups corresponding to MAC, PCS, and SPWG and that this subcommittee be chaired by the immediate past chair of SCC20 or designee, being the voting member represented on the Steering Committee.
10. It is recommended that standards writing subcommittees be represented on the Steering Committee with one voting member each, corresponding to the presiding co-chair for the current meeting.
11. It is recommended that liaisons to SCC20 be voting members of Steering and be restricted to the three society liaisons, the ARINC liaisons, and two special liaisons (currently corresponding to the US DoD liaison and the UK MoD liaison). The special liaison seats would be required to be reaffirmed every two years by Steering and the sponsoring organization, and additional special liaisons would be added as needed.
12. It is recommended that the SPWG be established as a permanent working group of the administrative subcommittee and that the SPWG proceed to the next phase of its task—the development of a strategic plan for carrying SCC20 into the 21st century and beyond.

It should be clear that several of these recommendations will require changes to the SCC20 Bylaws. Some may even require approval by the IEEE Standards Board. Therefore, if the above recommendations are accepted, action should be taken as soon as possible to update the Bylaws in accordance with the adopted changes and to receive the required approval from the IEEE.

ANTICIPATED BENEFITS

Several benefits can be anticipated by accepting the recommendations given above. These benefits relate to three aspects of SCC20: 1) the standards being developed by SCC20 for the IEEE (i.e., the product), 2) SCC20 itself (i.e., the organization), and 3) the administration of SCC20 (i.e., fiscal responsibility).

From the viewpoint of the product, the concepts being recommended benefit the IEEE in the quality of the standards themselves. Specifically, under the current organization, working groups are organized by standards projects, and communication between projects with similar or related scope is limited. Further, groups working on these separate projects are typically small and do not have sufficient resources to provide adequate coverage of the domain, resulting in the potential for oversight and complications in coordination. Under the recommended organization, domain experts developing standards are working under a shared work force with a common vision. If the experts working in related areas can be organized to work together, the resulting standards will benefit by improving technical quality, completeness, focus, and improved consensus within the community.

From the viewpoint of the organization, implementing the recommendations will benefit SCC20 itself in two ways. First adopting the vision will strengthen SCC20 as *the* system test standardization activity by providing a common focus for the work of the subcommittees. The expanded scope presented above provides a positive statement of the identity and direction of the committee and its subcommittees. This will result in a standards organization that will provide the IEEE and the test community with a *cohesive set* of test standards with a higher level of acceptability and confidence. Second, a more streamlined management structure for the standards projects will result in a more efficient and effective process for completing and publishing standards. SCC20 does not benefit from an organization where the Steering Committee is larger than any single standards-writing subcommittee—such a large management organization slows down standards development and approval. SCC20 needs to emphasize facilitating the work in the subcommittees where the standards are developed, and the Steering Committee should focus on providing vehicles for coordination and direction to maintain the focus of the standards projects on the SCC20 vision.

From the viewpoint of fiscal responsibility, improving the organization of SCC20 will also impact financial requirements of the committee and its participants. Expanding and clarifying the scope of the standardization activities in the committee should lead to increased marketability of the standards work and increased participation from industry in SCC20. This in turn will expand the membership-base over which to apportion meeting expenses which should lead to lower meeting registration fees. Further, by reducing the number of meeting rooms required (since there will be fewer subcommittees and working groups), overall meeting requirements will be lower, leading to more options for meeting sites. Finally, administration requirements would be reduced, thus improving the overall logistics of the meeting.

CONCLUSION

The SPWG was established to develop a formal statement of the vision and mission of SCC20. This document satisfies that requirement and offers several recommendations for SCC20 to adopt to fulfill its mission. Some of these recommendations will stretch the current resources of SCC20 while also re-organizing SCC20 to bring more resources to bear on the problems currently being tackled. At the same time, it is believed the new organization, name, and vision will provide a

vehicle for members of SCC20 to reach out to industry and attract experts interested and able to satisfy the mission of creating system test standards.

Currently, the IEEE has three standards bodies that have expertise and interest in developing test-related standards: the Test Technology Standards Committee of the Computer Society, the Design Automation Standards Committee of the Computer Society, and SCC20. It is evident that broad consensus in the need for test standards exists, given the sponsorship of SCC20 by three independent IEEE societies and ARINC. To date, TTSC has focused on developing standards related to chip testing, and DASC has focused on developing standards related to design and manufacture of electronic systems. Only SCC20 has undertaken efforts to provide standards applicable to unit and system test and diagnosis. It is fitting, therefore, that SCC20 be The System Test Standards Committee.

REFERENCES

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