



FEATURED CAPABILITY

The Joint Systems Integration Command (JSIC), Suffolk, Virginia

SPECIAL FEATURE

Partnering T&E for the Future: A series of nine articles addressing past, present and future test and evaluation partnering efforts

With top-level contributions from various Services/Government test organizations

TECHNICAL PAPER ABSTRACTS:

**A Successful Test and Evaluation Partnership
in a Commercial Business Environment**

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One of the constants in both the Department of Defense (DoD) and commercial testing environments is the pressure to maximize the use of, while simultaneously minimizing the capital investments for, test facilities. A concurrent pressure, and recent phenomenon, especially within the automotive industry, is the recognition that the test processes and the analysis of test data are the key proprietary properties resulting from testing, and the test facility, while key to the execution of the test, is generally not considered to be of the same proprietary nature. This paper presents an overview of a win-win-win arrangement within the automotive industry. A background to understand the commercial testing environment is presented, followed by a discussion of the implementation of a unique solution, which met the needs of all involved parties, concluded by a summary of the results of this first-of-a-kind partnership.

**Systems Engineering and Test: An Improved
Partnership Enabled by Modeling and Simulation**

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With the Department of Defense's (DoD's) new emphasis on capability-based acquisition, modeling and simulation (M&S) will necessarily assume a more important role in the acquisition process. However, there are obstacles to effective use and reuse of trustworthy models and simulations. This paper describes the initiative led by the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics, Defense Systems, to identify needed actions to improve the use of M&S. The needed actions will be the building blocks for a forthcoming Acquisition M&S Master Plan. This paper highlights those actions with the most significant implications for systems engineering and test.

Telemetry Band Augmentation and Harmonization: Planning for the Future of International Aeronautical Test and Evaluation

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One of the significant factors affecting the future of international test and evaluation is the planning, scheduling and utilization of aeronautical telemetry to support flight test, atmospheric research and other scientific applications requiring real-time radio frequency (RF) communications. Due to commercial spectrum encroachment and the resultant reallocation legislation in many countries, the increasing need for real-time data display and analysis is quickly becoming unsupportable in the existing bands. Harmonized international bands are needed to augment existing spectrum used by telemetry practitioners. Several research efforts have increased telemetry efficiency by decreasing the amount of spectrum needed to transmit information. These techniques, promising a two- to three-fold increase, still cannot address the need for future wideband telemetry, which is growing exponentially. This has generated a call to look for additional RF spectrum allocations to augment the existing telemetry bands. This need is shared by the international community and has generated an agenda item for the next meeting of the World Radiocommunication Conference (WRC). Due to the international impact of spectrum encroachment on telemetry users, the International Foundation for Telemetry established an information interchange forum, called the International Consortium for Telemetry Spectrum, to support this critical requirement. It is necessary that all telemetry users advocate a positive response to this WRC agenda item in their countries to meet the needs of future test and scientific programs. Failure to gather support within individual countries will result in failure of this item and will impact flight test, atmospheric research and space launch services across the global community.

Information Operations/Assurance in Joint Operations: Building Confidence Through Testing—A Daunting Challenge

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This paper discusses the dimensions of information operations (IO) from several perspectives: technical, functional, mission and others. It also begins to describe the challenges involved in transforming IO from a supporting to a core mission area, while building confidence at the same time. This paper addresses the catalyst, or center of mass, needed to move or gravitate toward a joint IO mindset. While it does not have all the answers, this paper does try to set a course for a test and evaluation end state that will result in confidence in IO offensive and defensive weapons or tools through testing.

Peer Reviews of Plans and Reports

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This paper guides peer reviewers of test plans and test reports. In particular, it traces the "plot" of these technical documents, or the linkage between the parts. In a plan, the major parts are the executive summary, purpose statement, example results tables with criteria, test limitations (vice system limitations), Measures of Performance (MOPs) and methodology. In a report, the major parts are the executive summary, test limitations (vice system limitations), results with criteria, MOPs (if the test item failed or if otherwise appropriate) and conclusion. This paper also contains review checklists and good and bad examples of most of the above.

Validating a Test Methodology for Conducting Systems-of-Systems Testing in a Joint Environment

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Testing future weapons systems in a realistic, network-centric joint environment will create many challenges. In recognition of this, the Director, Operational Test and Evaluation (DOT&E), recently completed a roadmap, "Testing in a Joint Environment," that outlines challenges in (1) test infrastructure and standards, (2) methods and processes and (3) policy.¹ Four working groups were formed to address these issues. As part of the Methods and Processes Working Group, DOT&E chartered a joint feasibility study to propose a joint test methodology to be validated in a Joint Test and Evaluation Program, which will begin this February. This paper presents the background to the Testing in a Joint Environment Roadmap; summarizes the history of using large-scale exercises and distributed environments to conduct experimentation and testing; and discusses the proposed methodology for the Joint Test and Evaluation Program developed to date. This includes linkages to common task-based languages and their decomposition, integrating the appropriate live-virtual-constructive environment for conducting the test, and measures of effectiveness and performance. Finally this paper discusses the approach to validating the methodology.



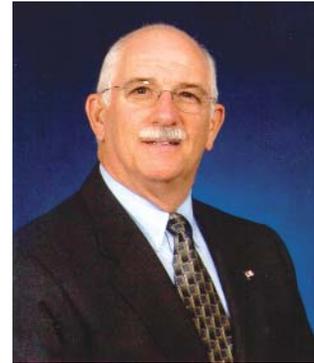
Looking Forward to a Great New Year

I hope that you and your families have enjoyed a glorious holiday and are looking forward to a great 2006. Our Association has experienced an interesting year, which, for the most part, I think has been very positive. At our Annual International Symposium held in Albuquerque, New Mexico, this past September, we enjoyed the exchange of ideas and concerns of more than 487 registrants, along with 70 exhibiting organizations. My sincere thanks go out to all who helped make the 2005 symposium a tremendous success by any measure. At the top of the list are **Symposium Chair Pat Cannon, Technical Chair Mark Smith, Logistics Chair Russ Foos and Exhibits Chair Doug Messer**. Their untiring, selfless efforts and enthusiastic leadership earned the appreciation and thanks of all in attendance.

One of the highlights of our Annual International Symposium is the Awards and Recognition Ceremony. Many deserving ITEA individual members, chapters and test and evaluation (T&E) community stalwarts were recognized for their exemplary contributions to ITEA and to our profession. You can read about the award winners in the "Association News" section of this edition of the *ITEA Journal* on page 98, but I would like to mention two winners here. For the past six years, **John T. "Tom" Best** has served as chair of ITEA's Awards Committee, and this was his last ceremony. In appreciation of his service, it was my great privilege to present Tom with the President's award for his 15 years of sustained support to ITEA. This year, we celebrated ITEA's Silver Anniversary. Yes, our Association is 25 years old. Many past presidents attended this year's event and were recognized at the Tuesday luncheon. This year, the Dr. Allen R. Matthews Award, ITEA's highest honor, was presented to **Dr. Charles K. Watt**. Not only is Dr. Watt a long-standing member of ITEA, but he served as the first elected President of ITEA as well. Recognition of years of service to ITEA and to the T&E community, along with his numerous achievements, was most appropriate.

As required by the Association's Bylaws, I presented a **2005 State of ITEA Message**. During 2005, ITEA conducted six workshops, seven short courses, 24 tutorials and the Annual International Symposium. In the past year, we introduced a very successful two-day "Open Forum for

Test and Training Investments" and offered two new short courses: "Radio Spectrum Management for T&E"; and "Red Team/Blue Team Assessments with Automated Tools for Information Assurance Test and Evaluation." Efforts are currently underway for ITEA's "Fundamentals of T&E" short course to receive



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the Defense Acquisition University Equivalency status. Individual ITEA membership remained steady at 1,674, as did the corporate membership at 90. ITEA signed a Memorandum of Agreement with the American Institute of Aeronautics and Astronautics (AIAA), thus expanding the Association's outreach program. We are currently completing discussions with the International Council on Systems Engineering (INCOSE) to sign a similar agreement.

In other ITEA business, I would be remiss if I did not recognize and thank the departing members of the ITEA Board of Directors: **Dr. John B. Foulkes, Amy J. Markowich, A. Martin Phillips, Judith Wettig** and **Dr. John A. Wiles**. We welcome their continued future involvement in and support of ITEA in other valued capacities. I also want to welcome the following new Board members: **George M. Axiotis, Drexel L. Smith** and **John Wiley**. We look forward to their contributions.

In October, I sent an e-mail to ITEA members announcing the impending retirement of **Alan Plishker** as the Executive Director of ITEA. Finding a new Executive Director is the most important immediate task of your ITEA leadership. Please take time to review the description of the responsibilities and required qualifications of this important position, which can be found on the ITEA web site, <http://www.itea.org>. I strongly urge each of you to assist the search committee by disseminating this information as widely as possible. Interested parties should contact **Michael A. Schall**, the **Search Committee chair**, at mschall@itea.org. □

Robert T. Fuller

ITEA's Partnering Endeavors

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***“Joint undertakings stand a better chance
when they benefit both sides.”*** —Euripides

Dr. James McCormack, chair of the ITEA Publications Committee, thought that, because the theme of this issue of the *ITEA Journal of Test and Evaluation* features partnering, our readers might be interested in a retrospective of ITEA's partnering efforts, as well as a look at some current and future Association partnering initiatives. Jim arm-twisted me into giving it a whirl on the editorial dance floor!

By glancing back, we can better appreciate how far ITEA has come, and where the Association is now poised for the future. Looking back over the years, it is difficult to distinguish between ITEA's "partnerships," "collaborations" and "co-sponsorships." The terms are frequently used interchangeably, and the distinction may only be in the eyes of the beholder. Like dance partners, some of the relationships have been for just one or two twirls, while others, like Fred and Ginger, have lasted for several years. When I joined ITEA as executive director in 1989, Dr. Steve Kimmel, then-chair of the American Defense Preparedness Association's (ADPA's) Test and Evaluation Division, had fostered a partnership between ITEA and ADPA. For more than six years, ADPA and ITEA danced together at the annual "Test and Evaluation Symposium."

In 1991, ITEA and the Military Operations Society (MORS) joined forces for two mini-symposia. With Dr. Patricia Sanders, a former ITEA Board Member and past ITEA president as our technical chair, ITEA went to Newport, Rhode Island, to try to "Put the 'E' back in T&E." It must have been beneficial for both

organizations, because we met again in 1994 in historic Williamsburg, Virginia—this time, to find an answer to long-time member and Past ITEA President Don Greenlee's life-long quest to discover "How Much Testing is Enough?"



R. Alan Plishker

From 1993 until 1995, ITEA was in step with the American Society of Test Engineers (ASTE) and co-sponsored a series of Test Technology Transfer Symposia. When ASTE dropped out in 1995, ITEA's Narragansett Bay and New England chapters formed an alliance to sponsor two Test Technology workshops. And, who could forget those memorable trips to London, England, that started in 1994 when Past ITEA President John Bolino—followed by long-time ITEA member Todd Stevenson and then-ITEA Board Members George Smith and Dr. John Foulkes—co-chaired the Aerospace Forums with the Royal Aeronautical Society? Some of us did not want the

music to stop.

Through the years, other ITEA partners have included the Society of Flight Test Engineers, who cooperated in publishing a flight-test-themed issue of the *ITEA Journal*; the American Society for Quality Control; and the Data Processing Management Association in joint ventures in software testing.

ITEA's inherent nature as a forum for the exchange of information in the test and evaluation (T&E) community is itself a prime illustration of the valuable role the Association continues to play in partnering with other organizations. Nowhere is this more evident than in ITEA's educational endeavors. For example, in 2004, Dr. John Claxton, program director, T&E curriculum,

Defense Acquisition University (DAU), Fort Belvoir, Virginia, initiated a Memorandum of Understanding (MOU) between ITEA and DAU. John worked closely with then-ITEA Education Committee Chair Tom Macdonald, and then-ITEA Assistant Director Norm Haack, to draft an agreement to share training resources and to provide collaboration on T&E training opportunities. The MOU has opened the door for ITEA to seek DAU equivalency status for ITEA's "Fundamentals of T&E" short course. Not only will this effort increase the possibility for a larger student base, but it also has the potential for wider recognition and status for an ITEA course.

Another partnership was negotiated by Larry Camacho, current chair of ITEA's Communications Committee, along with Don Greenlee, between ITEA and the American Institute of Aeronautics and Astronautics (AIAA). It was signed in 2005, but because it is still in its infancy, we will have to wait to see how viable this agreement will be. They are also working on a similar understanding with the International Council on Systems Engineering (INCOSE).

If you attended "Test Week 2004" in Huntsville, Alabama, you witnessed first-hand a successful one-time partnership between Army T&E Days, sponsored by the Army's Test and Evaluation Management Agency (TEMA), and ITEA. Under the leadership of former ITEA Board Member and Past ITEA President Dr. John Foulkes, then-director of TEMA, the ITEA Rocket City Chapter, ITEA Volunteer Chapter, ITEA Headquarters gathered together to combine Army T&E Days with ITEA's Annual International Symposium, thus forming "Test Week 2004." The two distinct technical programs were maintained separately, but the exhibits, registration process and logistics were a collaborative effort.

Partnering is alive and well on the ITEA chapter level as well, with many chapters joining other organizations to sponsor lunches, joint meetings, workshops and symposia. As George Washington (GW) Chapter member Fred McCoy recently reminded me, for more than six years the GW Chapter and the Association of Old Crows had partnered to hold annual luncheon meetings. There have been several successful alliances among ITEA chapters, notably the teaming of the China Lake and Antelope Valley chapters in hosting the Test Instrumentation workshops. The ITEA Southern Cross Chapter in Australia, thanks to

Chapter President Dr. Viv Crouch, has been "line dancing" with several professional societies, including the Systems Engineering Society of Australia (SESA) and INCOSE, to host an annual event "down under." This event has had the added value of strengthening ITEA's international presence.

But, from my perspective, one of the most valuable partnerships that ITEA has established has been with the Directed Energy Professional Society (DEPS). Since 2002, our two organizations have sponsored a conference held every August in Albuquerque, New Mexico. Under the leadership of DEPS Executive Director Dr. Sam Blankenship, ITEA Roadrunner Chapter President Pat Cannon, and Technical Program Chairs Mike Dieckhoff, Rick Graber and Thomas Hodge, the conference has addressed the needs and problems associated with testing radically new high-energy and high-power microwave technologies.

The conference has been a success not only because the directed energy and test communities see benefits, but also because DEPS and ITEA have benefited as well. In my estimation, there are several reasons for the success of this relationship. Both organizations are similar in size; neither one is dominated by the other. They share a common educational mission. The goal of this partnership is very specific: to host a successful workshop. Responsibilities are clearly delineated and, like any solid partnership, the two organizations complement rather than compete with one another. Hopefully, the "band will play on" for this annual event.

During the past few years, we have seen a proliferation of workshops, with overlapping themes and frequent recycling of the same speakers and program participants. It *does* make sense that partnering should be the wave of the future; but to continue to be successful, *there must be a benefit for all parties involved*. We must look beyond the same old boundaries, and do some creative thinking, to seek organizations with new and varied interests that will complement those of ITEA, while still mirroring the integrity of our Association. The vitality, longevity, success and strength of ITEA will depend on it. □

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Can Commercial IEEE 802 Technology Be Leveraged to Develop Network-Enhanced Telemetry for the T&E Community?

By G. Derrick Hinton

Military test and evaluation (T&E) data communications (that is, telemetry) focus on point-to-point transmissions. Large quantities of telemetry data are broadcast from a test platform to a ground test center over a one-way datalink. In fact, even range destruct (uplink) and time-space-position information (TSPI) tracking (downlink) are point-to-point communications.

The Central Test and Evaluation Investment Program (CTEIP) is reengineering telemetry by creating a telemetry network that will enhance the traditional point-to-point telemetry link with bi-directional platform-to-platform and platform-to-ground data transmissions. It is envisioned that this network could, in time, support other range datalink functions, to include TSPI and target control.

Because the T&E application is a small market, there is little incentive for industry to invest in new technology to develop this T&E network. Instead, the test community must capitalize on the vast investments in commercial and military wireless technology products. For example, a common commercial technology is WI-FI, which is part of the family of IEEE 802 wireless technologies.

The IEEE 802 LAN/MAN Standards Committee develops Local Area Network (LAN) standards and Metropolitan Area

Network (MAN) standards. The standards are primarily for the lowest two layers (that is, the physical and the link layers) of the International Standardization Organization (ISO) reference model for the Open Systems Interconnection (OSI). The most widely used standards are for Ethernet, Token Ring, Wireless LAN, as well as for the growing IEEE 802 series of wireless standards.

The IEEE 802 committee coordinates with other national and international standards groups, where some standards have been published by ISO as international standards. The primary active IEEE working groups involving wireless technologies include: IEEE 802.11 LAN; IEEE 802.15 Personal Area Network (PAN); IEEE 802.16 MAN; IEEE 802.20 Mobile Broadband Wireless Access; and IEEE 802.22 Wireless Regional Area Networks. These working groups have corresponding standards that are represented in *Figure 1* in terms of intended mobility versus data rates.

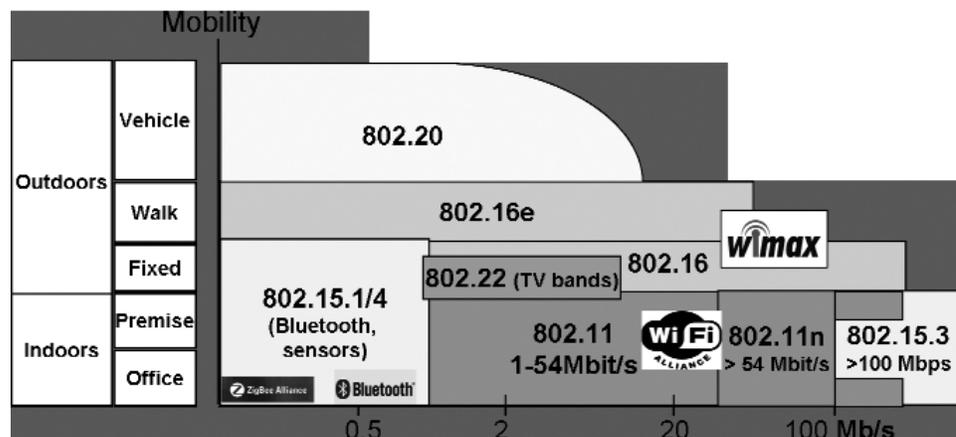


Figure 1. IEEE working groups' corresponding standards in terms of intended mobility versus data rates

Data rate

Because of the growing need to have interoperable ranges, the Department of Defense (DoD) must develop its own wireless (W) standards or adopt the prevailing IEEE 802 wireless standards to meet some of its most challenging requirements and to ensure the required level of quality of service. To investigate the feasibility of IEEE 802 technology for T&E applications, the CTEIP sponsored the 2-Way Robust Acquisition of Data (2-RAD) demonstration, which was conducted by the U.S. Army's Yuma Proving Ground (YPG) and the Johns Hopkins University's Applied Physics Laboratory (APL).

YPG has been using commercial off-the-shelf (COTS)-based 802.11b in wireless mesh architecture, probably the first use of this technology at very long ranges. The YPG WLAN is shown in *Figure 2*.

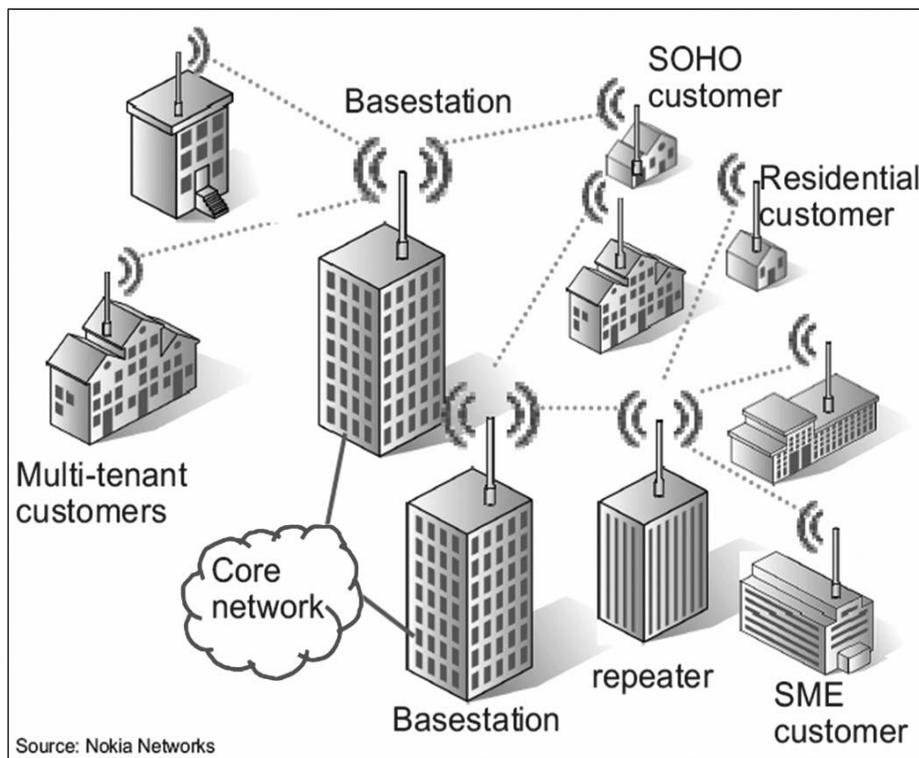


Figure 2. The Yuma Proving Ground WLAN

The backbone nodes (1 watt into an 11 dBi omnidirectional antenna) can theoretically be separated by a line-of-sight distance of 70 km. This radiated power level is only slightly beyond the indoor Federal Communications Commission (FCC) regulation for 802.11. One of the challenges of the 2-RAD program was to demonstrate that COTS-based 802.11b technologies could still operate in a high Doppler environment. A proof-of-concept test was completed with a 2.75" rocket, where the physical rate in-flight was measured to be the usual 11 Mbps.

Due to the success of programs such as 2-RAD, CTEIP intends to leverage the IEEE 802 technology (and other networking technologies) in executing the integrated Network-Enhanced Telemetry (iNET) program, which will augment conventional point-to-point telemetry with a network architecture. The iNET systems engineering approach will evaluate the

feasibility of supporting other datalink range functions, to include TSPI, destruct and target control. Network-enhanced telemetry should provide for safer test programs that deliver better weapon systems in less time and at lower cost. □

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