

TIA's
2004



STAR

STANDARDS AND TECHNOLOGY

ANNUAL REPORT



SIXTY YEARS
OF WRITING
STANDARDS

STEP BEYOND WHAT'S NEXT



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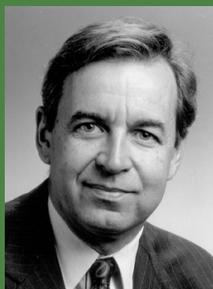


OVER 60 YEARS OF STANDARDS

The 2004 *Standards and Technology Annual Report (STAR 2004)* marks our 10th Anniversary edition. It also marks TIA's (and our predecessor organizations') more than 60 years of active standards development for the industry we serve. It was in March 1994 that then-Chairman of the TIA Board, John Major of Motorola, asked Dan Bart, vice president, technical and regulatory affairs, why TIA did not have an annual report highlighting TIA's standards work in addition to the regular TIA annual report highlighting TIA's trade association work. Dan responded that he was prepared to create a report (or even a prime time special) on TIA standards work, if John would provide the money! John Major replied, "Leave the budget to me, but show me what the Technical Committee wants to do by the August Board meeting."

At the May 1994 Technical Committee meeting the name *Standards and Technology Annual Report*, or "STAR," was born. It was to be a "thank you" to the hundreds of companies and other organizations and technical experts that support the TIA standards program. It would highlight the year's accomplishments, pro-

John Major
TIA Chairman, 1994



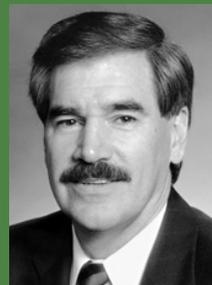
Michael D. Kennedy

TIA Chairman
Senior Vice President and Director,
Global Government
Relations
Motorola



Matthew J. Flanigan

TIA President



vide a view of the next year's challenges, and demonstrate our support for global markets and international standardization. It could also have other educational material such as articles and was to be a portfolio piece distributed to all TIA members and each person who participated in TIA standards work as a "thank you."

At the August 1994 TIA Board meeting, the proposal for *STAR 1994* was presented. It included the fact that TIA would celebrate its Golden Jubilee of 50 years of standards development in November 1994, since TIA's oldest continuously meeting Engineering Committee, TR-8 (then called the Committee on Emergency Service, Transmitter Division, of the Radio Manufacturers Association [RMA] Engineering Department) had held its first meeting on November 29, 1944, at the Hotel Biltmore in New York City.

In addition to the release of *STAR 1994*, a Gala Golden Jubilee event was also proposed. The TIA Board modified the STAR proposal to make it even better. The Board stated they wanted all organizations supporting the





TIA standards program to be listed in STAR even though that added pages and thus cost; they also doubled the print run, and directed the TIA Communications Department staff to focus on the quality of the publication. They did not include it in the TIA budget;

instead, sponsors for *STAR* were to be solicited, and several TIA Board members were prepared to write checks then and there, including the chairman.

Over the years, *STAR* grew stronger and better, more color was added, the orientation of the pages changed periodically, and marketing data was added to show how TIA standards work helps drive global markets. If you consider just a few TIA standards and then estimate the resulting revenues to the industry, you will see what we mean:

- TIA standards in support of the International Telecommunication Union's (ITU) IMT-2000 initiative for both Code Division Multiple Access (CDMA) from TR-45.5 and Time Division Multiple Access (TDMA) from TR-45.3 have produced sales of almost

200 million handsets and other devices, and hundreds of networks and cell sites worldwide, and have generated billions of dollars of revenue for vendors and carriers.

- TIA's Project 25 suite of standards from TR-8 has yielded thousands of first-responder installations in more than 50 countries worldwide, providing advanced, secure, digital, spectrum-efficient, interoperable communications for public safety and protection of our families.
- Modem standards from TR-30 drove the ITU's V.90 Recommendation, which is the basis for all dial-up modems in computers today.
- The standards in TR-42's Commercial and Residential Building Wiring series are used in probably every newly constructed building in the United States today.

At TIA it is not "standards AS a business, but standards FOR business!"

So again, we wish to thank the companies and other organizations that support our world-class standards program and to applaud the hard work and dedication of the numerous subject-matter experts who populate our formulating groups and develop TIA standards. Join with us as we celebrate a decade of *STAR* and more than 60 years of active standards development.

Sincerely,

(To browse *STAR 1994* and other years, visit <http://www.tiaonline.org/standards/star/>.)



Anil Kripalani

TIA Technical Committee Chair
 Senior Vice President, Global
 Technology Marketing
 QUALCOMM



As stated in the *TIA Engineering Manual*, Section 2.4.1: “The Technical Committee is one of the special committees created by the Board of Directors and chaired by a member of the board to oversee the Standards and Technology Department and the standards program. The Technical Committee (TC) has overall responsibility for establishing the broad technical policy of the association, including the organization and operating policies of the Standards and Technology Department and engineering committees, and advises the Board of Directors on technical issues.” As Chair of the Technical Committee, I also chair the Technical Standards Subcommittee (TSSC). I have pledged to have at least one TC meeting per quarter, whether as a face-to-face meeting or a conference call. In 2004, the TC, the TSSC and the TC’s Intellectual Property Rights Standing Committee met that goal, making 2004 a busy year.

STAR 2004 highlights the 10th Anniversary of the publication and over 60 years of active standards development work at TIA (and its predecessors) for the industry.

Standards development at TIA continued at full throttle despite economic conditions in 2004. The association took every opportunity to continue to work with the standards program leadership to reduce costs, including hosting meetings at TIA instead of off site and limiting travel to only essential trips. These efforts resulted in further reduced meetings costs and resources spent on supporting the groups.

Accomplishments

TIA and its engineering committees, subcommittees and working groups continued to meet industry demand for standards documents and accomplished much in 2004.

- 102 new projects were opened, 192 standards proposals/ballots were issued and numerous items were reviewed by the TSSC.
- 186 documents were published, reaffirmed, revised, upgraded or withdrawn.

As Secretariat, the association maintains more than 1,000 documents — from both TIA and the Third Generation Partnership Project 2 (3GPP2).

Staff continued to make improvements to TIA’s Web and file transfer protocol (FTP) sites in 2004. These sites contain copies of the TIA Engineering Manual, advisory notes and forms used to process standards. In addition, wireless and wired local area networks are being more extensively used for on-site distribution of work products created during engineering committee meetings, as well as providing broadband access for the meetings.

The association wrapped up a major initiative launched at the request of the TIA Board to survey all committees, projects and priorities of the various standards groups supported by TIA, “recasting” and possibly renaming or restructuring the groups to show



more forcibly how they directly support new technologies being developed across the industry. The board also reaffirmed a policy on promotion of standards maintaining technology and company neutrality by TIA, the standards development organization.

International Participation

On the international standards front, TIA participated in the work of the International Telecommunication Union (ITU) and its Telecommunication Standardization (ITU-T) and Radiocommunication (ITU-R) sectors, as well as in the work of the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), and ISO/IEC Joint Technical Committee 1 on Information Technology (JTC1).

Major issues such as support for public protection and disaster relief activities, next-generation networks (NGN) (i.e., packet data, fixed/mobile convergence), infrastructure and network security, as well as intellectual property rights policies for copyright on source code used in Recommendations (ITU standards), took a great deal of time. TIA updated the ITU on changes, enhancements and new features added to its 3G wireless standards referenced by ITU-R as part of the Union's International Mobile Telecommunications (IMT)-2000 initiative to develop global 3G standards. TIA also facilitated the referencing of a TIA-developed Internet protocol over satellite (IPoS) solution by multiple ITU-R draft Recommendations, and TR-30 and other TIA groups developed several IP-related contributions for input to ITU. As you review the reports from each of the engineering committee chairs, you will see where IP, VoIP, XXoIP, IPoS, GigETHERNET, NGN and advanced broadband network standards for both the public and private sectors are being developed at TIA. We continue to be the forum of choice for new projects and new technologies.

The association also remained actively involved in the Inter-American Telecommunication Commission (CITEL), an agency of the Organization of American States, and participated in the Global Standards Collaboration (GSC-9) meeting hosted in Seoul, Korea, GSC-9 (May 9-13, 2004). TIA is now preparing for GSC-10 in Sophia Antipolis, France (August 28-September 2, 2005) and planning has also begun for GSC-11 to be hosted by TIA in Chicago in May/June 2006 in conjunction with GLOBALCOMM™ 2006.

TIA continued in its role as participant in and the Secretariat to 3GPP2. Together with the European Telecommunications Standards Institute, TIA also sponsors Project MESA — Mobility for Emergency and Safety Applications. Project MESA is a public safety partnership that is the first international initiative to involve users and organizations from the public protection, disaster response and civil defense sectors in the development of user requirements and specifications to meet broadband mobile communications needs. Interest in public safety standards has continued to grow both domestically and internationally, as users seek enhanced capabilities and interoperability of first-responders.

Leadership Roles

TIA maintained several other leadership roles in standardization in 2004, many of which are ongoing.

- Participated on the ANSI Board of Directors and ANSI Executive Committee, as well as on ANSI's Executive Standards Council, Company Member Forum, Consumer Interest Forum and Patent Group, and chaired the Copyright Ad Hoc of the ANSI Executive Committee.
- Participated on the ANSI Organizational Member Forum and chaired its Digital Rights Management



**3RD GENERATION
PARTNERSHIP
PROJECT 2
"3GPP2"**

Project
MESA



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Ad Hoc. Held leadership positions in the U.S. National Committee to the International Electrotechnical Commission.

- Was an ANSI delegate in January 2004 at the ANSI/European Standards Organizations' (ESOs) (CEN/CENELEC/ETSI) meeting in Nice, France. Security standards were a topic on that agenda and were discussed again at the January 2005 ANSI/ESO meeting in Washington, D.C., where TIA was the issue manager for voice over Internet protocol (VoIP), as well.
- Is part of the governance structure of the United States National Committee (USNC) to the International Electrotechnical Commission (IEC). TIA also provides Secretariat and Technical Advisory Group (TAG) Administrator services to several IEC groups and TAGs and one group for the International Organization for Standardization (ISO) US TAG for TC-204 in the area of Intelligent Transportation Systems (ITS). TIA was also selected to lead a Working Group on wireless infrastructure for Sector Board 4 of the IEC.
- TIA's Dan Bart continued as the private sector co-chair of ANSI's Homeland Security Standards Panel. (ANSI HSSP) and moderated Emergency Communications and Citizen Preparedness Workshops in December in Chicago. He received a 2004 Meritorious Service Award from ANSI for his leadership in the ANSI HSSP.

With the transition to the new Department of Homeland Security (DHS) in 2003 and the release of President Bush's Homeland Security Presidential Directive 7 (HSPD-7), TIA continued in 2004 to serve as a Communications Sector Coordinator in support of HSPD-7 regarding critical infrastructure protection (CIP) and is a non-resident member of the National Coordinating Center — Communications Sector — Information Sharing and Analysis Center (NCC C-ISAC). Furthermore, TIA has a board seat on the Partnership for Critical Infrastructure Security (PCIS), which handles cross-sector CIP issues.

Also in 2004:

- TIA was named to the National Cyber Security Partnership (NCSP) Steering Committee. This private/public partnership effort supports DHS and other government initiatives directed at cyber security.
- TIA was part of the Emergency Notification System (ENS) of the DHS Information Analysis Infrastructure Protection Directorate (DHS IAIP).
- TIA participated in several ANSI HSSP activities, including two plenary meetings and several workshops. The ANSI HSSP, as another cross-sector activity, is the coordinating body for the development and enhancement of homeland security and emergency preparedness standards and conformity assessment, as developed by ANSI and non-ANSI members.
- TIA was appointed to the advisory committee of the National Public Safety Telecommunications Council (NPSTC). TIA was also appointed to the advisory committee for DHS SAFECOM.
- TIA and its members have been involved in the activities of President Bush's National Infrastructure Advisory Council (NIAC). Activity included prioritization of cyber vulnerabilities.
- As a Sector Coordinator and neutral industry forum, TIA provided input to the draft U.S. National Response Plan, Private Sector Support Annex (2003/2004) via the NCC C-ISAC and DHS Private Sector Office.
- TIA was asked to participate on a National Security Telecommunications Advisory Committee (NSTAC) Industry Executive Subcommittee Task Force focusing on next-generation networks (NGN) national security/emergency preparedness (NS/EP) needs. TIA is actively participating in working groups of the task force.
- TIA participated in the Department of Commerce's Economic Security Working Group (EconSec WG) meetings and participates in its subgroups focused on such topics as international



outreach, research and development, and support for bi/multi-lateral meetings.

- TIA supported the Global Disaster Information Network (GDIN) event in March 2004.

- The TIA Intellectual Property Rights policy was revised, and ANSI closed our 2003 Audit Report during 2004.

As the TC Chair I also want to thank those companies, organizations and subject matter experts that support our standards program at TIA. *STAR 2004* heralds your accomplishments. Thank you!

Anil Kripalani, QUALCOMM
TIA Technical Committee Chair



Engineering Committee TR-8 develops and maintains standards for private radio communications systems and equipment for both voice and data applications. TR-8 addresses all technical matters for systems and services, including definitions, interoperability, compatibility and compliance requirements. The types of systems addressed by these standards include business and industrial dispatch applications, as well as public safety (police, ambulance, fire fighting, etc.) applications.

Committee TR-8 is the standards formulation committee for Private Land Mobile Radio Systems. The standards developed by TR-8 are used to produce equipment for a number of services including business, industrial, transportation and public safety applications. Quite often, this equipment is deployed in mission-critical applications. Therefore, issues of radio coverage, reliability and security are of prime importance. In addition to standards for the equipment itself, the committee develops standards and bulletins that cover issues, such as radio coverage, interference protection and radio frequency (RF) exposure, that limit verification and reporting. The standards formulated by the committee cover all aspects of the system including antennas and combining networks, subscriber equipment, fixed station equipment and network equipment. Most of the work of the committee involves standards for advanced digital voice and data systems. However, the committee continues to be involved in standards for the more traditional analog frequency modulated (FM) systems. More recent activities include the formulation of standards for wideband and broadband data systems.

2004 Activities

There continues to be a high level of activity within the TR-8 committee. TR-8 and its subcommittees met five times during the year. The meetings were held in conjunction with the APCO/NASTD/FED Project 25 meetings. (APCO/NASTD/FED is a collective group of the Association of Public Safety Communications Officials International, Inc. [APCO]; the NASTD; and federal government agencies.) In addition to face-to-face meetings, many of the subcommittees and working groups advanced their work by meeting through teleconferences and using electronic working methods, including email and the distribution of documents through a local area network at the meetings. During 2004 a great deal of effort was expended toward the completion of wideband data standards for the 700 MHz frequency band. This project resulted from a request from the National Coordination Committee (NCC), an advisory committee to the Federal Communications Commission (FCC) on issues concerning deployment of the 700 MHz frequency band. Because the NCC charter expired in July 2003, it was important that the standards defining interoperability be completed prior to

Photo courtesy of Motorola Inc.



John Oblak

Chair, TR-8
Chief Engineer
E.F. Johnson

Vice Chair: Alan Wilson
Motorola Inc.



that date. Having completed the wideband data standards for the 700 MHz frequency band, the work of TR-8 in 2004 continued with the maturing of these standards. Work also began on broadband standards for equipment in the 4.9 GHz public safety frequency band.

Many of the TR-8 subcommittees continued to work on Project 25 digital private radio standards. This suite of standards currently consists of 37 published documents plus addenda to three documents. The majority of work consisted of refining the standards suite by upgrading some of the Telecommunications Systems Bulletins (TSBs) to TIA and TIA American National Standards (ANSs). In 2004 three standards related to Project 25 were revised and upgraded. The work of revising the Project 25 suite of standards is continuing, with nine documents currently in a state of being balanced or published. Renewed effort is being expended to round out the standards suite with standards for an inter sub-system interface, console interface and fixed station interface.

Subcommittee TR-8.5, Signaling and Data

Transmission, spent the year upgrading and expanding the suite of documents. The establishment of the 700 MHz frequency band and the request of the NCC for TR-8 to develop interoperability standards for wideband data systems necessitated a project to develop standards for such systems. TSB902.AAAA, Wideband Data Systems Security Services Overview, was published as part of this effort. In addition, two new documents and a revision of one of the documents have been drafted.

Subcommittee TR-8.8, Broadband Data Systems, was created to formulate standards in the area of broadband data systems. They also have a mandate to

accept inputs from Public Safety Partnership Program, Project MESA (Mobility for Emergency and Safety Applications) for publication as TIA standards. The primary focus of TR-8.8 is drafting standards for equipment to be used in the newly allocated 4.9 GHz public safety frequency band.

Subcommittee TR-8.11, Antennas, has continued work on a revision to the vehicular antenna, to be published as TIA-2329. In addition, a revision to *Terrestrial Land Mobile Radio – Antenna Systems – Standard Format for Digitized Antenna Patterns* was published as TIA-804-A. As a result of an expanded scope for the subcommittee that includes antenna system components, a document, TIA-929, *Standard Format for Digitized Filter Specifications*, which was published in 2003, had its addendum published in 2004.

Subcommittee TR-8.17, Radio Frequency (RF)

Exposure, has continued its work toward the development of guideline documents for compliance with FCC-mandated RF exposure limits for mobile, portable and base-station equipment. A document that provides a template for reporting of Specific Absorption Rate (SAR) data, entitled TSB150, *Private Land Mobile Radio Two-Way Portable Equipment RF Exposure (EME) Test Report Guidelines*, has been published. In addition, a document for reporting Maximum Permissible Exposure (MPE) data is being drafted and is expected to be released in 2005.

Subcommittee TR-8.18, Wireless Systems

Compatibility, continues to work on issues of interference prediction and spectrum compatibility. TSB88-B, *Wireless Communications Systems – Performance in Noise and Interference Limited Situations – Recommended Methods for Technology-Independent Modeling, Simulation, and Verification*, was published. One of the issues addressed in this document upgrade is the interference potential between systems incorporating some of the newest digital technologies. TR-8.18 continues to provide input on interference and radio coverage issues that impact public safety users. Work on revision C of TSB88 has already begun to address these new technologies.



There has been widening interest in the work of the TR-8 committee in 2004. Participation in the standards process by the traditional members, as well as newly participating manufacturers has expanded the committee's capabilities and added to the level of interest. In addition, there is increasing interest by the user community at all levels. The public safety community's needs for secure, reliable, interoperable communications systems, the allocation of new frequency spectrum, and advances in technology have caused a great deal of activity within the committee. TR-8 anticipates the coming year to be one of continuing challenges and opportunities as the work scope broadens with increasingly sophisticated technology.



The original chair of Committee TR-8, engineering pioneer Dr. Daniel E. Noble (left), shown in 1941 with the industry's first commercially available FM mobile transmitter. With Noble is fellow Motorola engineer Norm Wunderlich. *Photo and research courtesy Motorola Museum of Electronics.*

SUBCOMMITTEES

TR-8.1 Equipment Measurement Procedures
Chair: John Oblak
E.F. Johnson

TR-8.3 Encryption
Chair: Richard Brockway
Etherstack

TR-8.4 Vocoder
Chair: Rich Frye
IPC

TR-8.5 Signaling and Data Transmission
Chair: Jeff Anderson
Motorola Inc.

TR-8.6 Equipment Performance Recommendations
Chair: Terry Mansfield
Motorola Inc.

TR-8.8 Broadband Data Systems
Chair: Larry Nyberg
Motorola Inc.

TR-8.10 Trunking and Conventional Control
Chair: Stan Hansen
Motorola Inc.

TR-8.11 Antennas
Chair: Louis Meyer
Andrew Corporation

TR-8.12 Two-Slot TDMA Systems
Chair: Dominick Arcuri
RCC Consultants

TR-8.15 Common Air Interface
Chair: Alan Wilson
Motorola Inc.

TR-8.17 RF Exposure
Chair: Robert Speidel
Tyco Electronics

TR-8.18 Wireless Systems Compatibility
Chair: Bernie Olson
Motorola Inc.

TR-8.19 Wireline Systems Interface
Chair: Jerry Drobka
Motorola Inc.



TR-14 is responsible for standards and recommended practices relating to terrestrial fixed point-to-point radio communications equipment and systems (microwave radio), primarily in the frequency bands above 960 MHz.

2004 Activities

Within the TR-14 Committee, only **TR-14.7, Structural Standards for Steel Antenna Towers and Antenna Supporting Structures**, was active in 2004. The subcommittee completed editorial revisions of the updated standard for the tower industry: ANSI/TIA/EIA-222, *Structural Standards for Steel Antenna Towers and Antenna Support Structures* and it was released for public review ballot in early December 2004 with a close date in early February 2005. It is anticipated that Version G will be released for publication in June of 2005.

TIA-222-G will contain the most sweeping change in the 222 standard since Version D was implemented nearly 20 years ago. Version G of TIA-222 will contain new material and expanded content. Comprised of 15 chapters with 14 annexes, it has been prepared by eight different task groups, covering technical issues such as wind and ice loading, seismic loading, design stresses, safety and climbing, and geotechnical requirements.

For sheer volume of information, the TIA-222-G standard will surpass its predecessors by three or four times, including more than 150 pages devoted to state-by-state map graphics illustrating wind, ice, frost and seismic factors. All new tower construction and major renovations of existing structures will be expected to follow TIA-222-G. Existing towers will not be expected to conform to the updated

standard unless physical alterations are made or antenna loading exceeds the original approved design. Which version of the standard applies to a structure is usually a decision of the engineer of record.

As an example of changes in the revised standard, there are changes in geotechnical definitions, such as “normal soil,” for determining lateral load capacities, bearing load capacities and resistance to pull-out. “Normal soil” is defined at this time as a set of parameters always intended for bidding purposes. Over the years, it became practice, and in some instances foundations were actually installed for normal soil. The committee has eliminated the term, and values for soil will be provided that are representative of soil types similar to those used in building codes (e.g., values representative of sand, clay, etc.). The goal is to provide real-world, conservative values and to drive purchasers toward the use of a geotechnical report to solve initial installation problems and economics.

The committee’s intent is to create an internationally recognized and acceptable standard that can be implemented beyond the North American



Craig Snyder

Chair, TR-14
President
Sioux Falls Tower &
Communications



market. The intent of the committee is to have this version of the standard eclipse the state of the art of any other tower standard in the world. The standard will be incorporated by reference in the upcoming release of the International Building Code, which means that by default it becomes the most widely recognized tower standard of most countries, states and municipalities for their building codes, although there is often a lag of two to three years for the local level to incorporate new or revised standards.

SUBCOMMITTEES

TR-14.3 Station Grounding
Inactive

TR-14.6 Standard Microwave Transmission Systems
Inactive

TR-14.7 Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

Chair: Craig Snyder
Sioux Falls Tower & Communications

Vice Chair: Brian Reese
Aero Solutions LLC

TR-14.10 Electrical Performance Standards for Television Relay Facilities
Inactive

TR-14.11 Interference Criteria for Microwave Systems in the Safety and Special Radio Services
Inactive

TR-14.12 Waveguide Components
Inactive



Engineering Committee TR-30 develops standards related to the functional, electrical and mechanical characteristics of interfaces between Data Circuit-Terminating Equipment (DCE), Data Terminal Equipment (DTE) and Multi-Media Gateways, the telephone and Voice-over-Internet Protocol (VoIP) networks, and other DCE and Facsimile Systems.

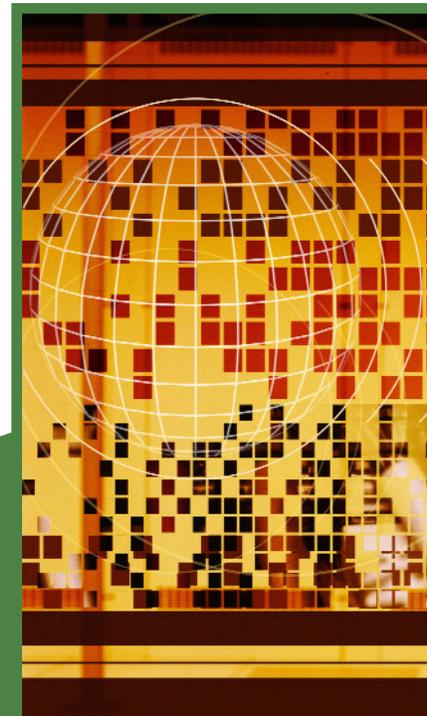
2004 Activities

2004 was a year of change and success for TR-30. Change came in the form of incorporating Subcommittee TR-30.5 on Facsimile Systems into Subcommittee TR-30.1. The workload within Subcommittee TR-30.5 had declined to the point that it was more efficient to combine the groups. The major success was within **Subcommittee TR-30.1, Modems**, where the new standard TIA-1001, *Transport of TIA-825-A Signals over IP Networks*, was approved. This standard provides for the reliable transport of text telephony (telecommunications device for the deaf [TDD] and teletypewriter [TTY]) over Internet protocol (IP) networks. This standard was in response to difficulties that had been seen with reliable operation of TDDs over IP networks with different levels of quality of service. The loss of packets in IP networks and voice compression algorithms has also been seen to limit proper operation of TDDs. Subcommittee TR-30.1 built upon the experience it gained in the development of ITU-T Recommendation V.150.1, Modem over IP, in the development of TIA-1001.

Subcommittee TR-30.1 also continued to foster its close working relationship with ITU-T Study Group (SG) 16, “Multimedia Services, Systems and Terminals,” in particular the Question 11 “Voiceband Modems:

Specification and Evaluation Performance” rapporteurs group. The two groups work seamlessly with experts from Question 11 invited to participate at Subcommittee TR-30.1 meetings. In addition, TIA hosted the Question 11 rapporteurs meeting in Washington, D.C., in August of 2004. Subcommittee TR-30.1 provided input to the development of ITU-T Recommendation V.152, “Procedures for Supporting Voice-Band Data over IP Networks,” which was approved by the ITU-T in 2004. Building upon its success in developing the TIA-1001 standard, Subcommittee TR-30.1 is providing input to the development of a new ITU-T Recommendation (V.151) which will provide for reliable transport of legacy text telephony-over-IP (text-over-IP). Work also continued with sustaining amendments to the V.150 family (modem-over-IP networks) of ITU-T Recommendations.

Subcommittee TR-30.1 agreed to withdraw TSB43, *Recommendations for DTE Compatibility with EIA/TIA-578 DCEs and Corrections to Example Sessions* because it was no longer relevant to the industry and the material had been incorporated in other documents.



Fred Lucas

Chair, TR-30
FAL Associates



Subcommittee TR-30.2, DTE-DCE Interfaces and Protocols, opened a project to revise TSB89, *Application Guidelines for TIA/EIA-485-A*.

Subcommittee TR-30.3, Data Communications Equipment Evaluation and Network Interfaces, concentrated its efforts on the continued development of PN-3-0062, *Network Model for Evaluating Multimedia Transmission Performance over Internet Protocol* (to be published as TIA-921). TIA-921 will define statistically-based network models and scenarios for evaluating and comparing communications equipment connected over converged wide-area networks. Test scenarios include public-switched telephone network (PSTN) to PSTN connections through a managed IP network; PSTN to IP connections and IP to IP connections. Operating companies, service providers, manufacturers, design engineers, test houses, magazines and product reviewers can use this network model to evaluate the performance of IP Network Devices such as: Voice over IP (VoIP) gateways, IP

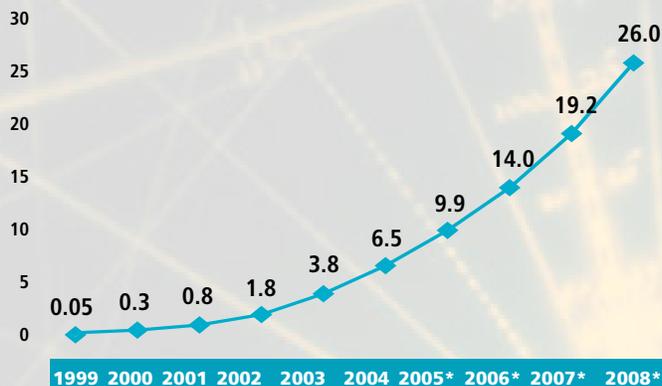
telephones, ITU-T Recommendation T.38 (Procedures for Real-Time Group 3 Facsimile Communication over IP Networks) facsimile devices/gateways, ITU-T Recommendation V.150.1 modem-over-IP gateways, ITU-T Recommendation V.152 Voice Band Data over IP gateways and, TIA-1001 and ITU-T Recommendation V.151 Textphone-over-IP gateways. Subcommittee TR-30.3 has established liaisons and working relationships with TIA Subcommittee TR-41.4, IP Telephony Infrastructures, IETF (Internet

SUBCOMMITTEES

- TR-30.1** Modems
Chair: Keith Chu
Mindspeed Technologies Inc.
- TR-30.2** DTE-DCE Interfaces and Protocols
Chair: Fred Lucas
FAL Associates
- TR-30.3** Data Communications Equipment Evaluation and Network Interfaces
Chair: Jack Douglass
Spirent Communications

Engineering Task Force) and ITU-T Study Group 11, "Signalling requirements and protocols"; SG 12, "Performance and quality of service"; SG 15, "Optical and other transport network infrastructures"; and SG 16, "Multimedia terminals, systems and applications."

VoIP Access Lines (Millions)



Source: TIA's 2005 Telecommunications Market Review and Forecast
* Projected

Subcommittee TR-30.3 opened new two projects to revise TSB18-A, *The Mechanical/ Functional Characteristics of the Interface between DCEs and Voiceband Analog Channels*, and TSB38, *Test Procedure for Evaluation of 2-Wire 4-Kilohertz Voiceband Duplex Modems*.



Engineering Committee TR-34 is responsible for standards and studies related to satellite communications systems, including both the space and earth segments. The committee focuses on standards for space-borne and terrestrial hardware; interfaces between satellite and terrestrial systems; and the efficient use of spectrum and orbital resources, including sharing between satellite and terrestrial services. Active projects range from studies on how best to accomplish interservice spectrum sharing to developing standards for achieving interoperability between satellite systems as well as among satellite and terrestrial systems, networks and services.

2004 Activities

During 2004, Engineering Committee TR-34's activities were concentrated in developing standards for satellite communications systems, with a major focus on the Internet via satellite. This work is accomplished in **Subcommittee TR-34.1, Communications and Interoperability**. **Subcommittee TR-34.2, Spectrum and Orbit Utilization**, was not very active during 2004.

Subcommittee TR-34.1 often accomplishes its tasks through ad hoc working groups (WGs), all of which address issues related to the interoperability of the satellite and terrestrial components of communications systems, centered primarily on existing and future standards development including Internet, Asynchronous Transfer Mode (ATM) and Global System for Mobile Communications (GSM); and their seamless operations over satellite transmissions paths and the detail common air interfaces.

The TR-34.1 Ad Hoc Working Groups that have done this work are:

- Internet Protocols over Satellite
- Common Air Interface for Processing Satellites
- IP Multicast over Satellite
- Common Air Interface for Satellite Systems for Residential Market
- TCP Protocol for the IPSEC Environment

The output of TR-34.1 generally consists of TIA Telecommunications Systems Bulletins (TSBs), TIA Standards, updates to Interim Standards (ISs), and American National Standards (ANS). Working groups collaborate, when delegated, with appropriate national or international standards bodies.

The *TR-34.1.7 Working Group on Internet Protocols over Satellite* had liaison activities with the IETF Transmission Control Protocol-Satellite (TCP-Sat) Working Group, with the goal of ensuring that Internet protocols will not preclude the use of satellites for Internet access.

Work was started on QoS Signaling for IPv6 Support as Project Number PN-3-0158. It has progressed considerably and is likely to be completed soon and will be published as TIA-1039.





Prakash Chitre

Chair Pro Tem, TR-34
Vice-President of
Technology Development
Viasat

TR 34.1 also developed several specifications in 2004 including TIA-1008 IPoS, which was published as a co-endorsed document by ETSI SES:

TIA document #	ETSI document #
TIA-1008	TS-102354

Work was initiated on PN-3-0109-RV1, which adds high-speed inroutes and interoperability with the DVB-S2 outroute to IPoS and which will be published as TIA-1008-A. Work was also started on a star-mesh architecture for TIA-1008 as a separate initiative.

A considerable amount of work was undertaken on an IP modem specification. IP Modem Functional capabilities Document was developed under PN-3-0179 and will be published as TIA-157.

The TIA-1040 Series is a co-endorsement of ETSI RSM-A air interface specifications and published as:

TIA document #	ETSI document #
TIA version 1040-1.01	TS-10218801v010102p
TIA version 1040-1.02	TS-10218802v010102p
TIA version 1040-1.03	TS-10218803v010102p
TIA version 1040-1.04	TS-10218804v010102p
TIA version 1040-1.05	TS-10218805v010102p
TIA version 1040-1.06	TS-10218806v010102p
TIA version 1040-1.07	TS-10218807v010102p
TIA version 1040-2.01	TS-10218901v010102p
TIA version 1040-2.02	TS-10218902v010102p
TIA version 1040-2.03	TS-10218903v010102p

In addition, TR 34.1 has begun an initiative to develop network layer specifications for IP communications over satellite links. This work is similar to ETSI SES BSM SI-SAP architecture. TR 34.1 has a formal

relationship with ETSI SES. The two groups have exchanged information during the year.

TR 34.1 has been collaborating with DVB Project's RCS TM group to enhance their connection control protocol for DVB-RCS single hop mesh architecture for non-regenerative satellites. The plan is to have a co-endorsed document for the DVB-RCS mesh configuration.

Global Mobile Satellite Services Revenues (\$ Billions)



Source: TIA's 2005 Telecommunications Market Review and Forecast
* Projected

SUBCOMMITTEES

TR-34.1 Communications and Interoperability
Chair: Tony Noerpel
Hughes Network System

TR-34.2 Spectrum and Orbit Utilization
Inactive



Engineering Committee TR-41 addresses voluntary standards for telecommunications terminal equipment and systems, specifically those used for voice service, integrated voice and data service and Internet protocol (IP) applications. The work involves developing performance and interface criteria for equipment, systems and private networks, as well as the information necessary to ensure their proper interworking with each other, with public networks, with IP telephony infrastructures and with carrier-provided private-line services. It also includes providing input on product safety issues, identifying environmental considerations for user premises equipment and addressing the administrative aspects of product approval processes. In addition, TR-41 develops criteria for preventing harm to the telephone network. These criteria become mandatory when adopted by the Administrative Council for Terminal Attachments (ACTA).

Committee TR-41 develops standards for wireline and IP telephony terminal equipment ranging from individual consumer telephones to large enterprise systems. TR-41 continues to be a dynamic standards committee responding to the changing needs of the industry, particularly with regard to voice over Internet protocol (VoIP). Three working groups were deemed inactive after completing their assigned development tasks. Three new working groups were created to address new subjects, and one former working group was reactivated to revise a document it had created.

TR-41 maintains liaison relationships with a number of standards bodies, consortia and councils. The list includes the European Telecommunications Standards Institute's Speech Transmission Quality (ETSI STQ)

Technical Committee, the Institute of Electrical and Electronics Engineers (IEEE) Subcommittee on Telephone Instrument Testing (STIT), and the Alliance for Telecommunications Industry Solutions (ATIS) Network Interface, Power and Protection Committee (NIPP — formerly T1E1).

2004 Activities

During 2004, new liaison relationships were established with the IEEE 802.1 Higher Layer LAN Protocols Working Group and the ATIS Network Performance, Reliability, and Quality of Service Committee (PRQC — formerly T1A1). Informal liaison was also maintained through common membership participation in the IEEE 802.11 Wireless Local Area Network (WLAN) Working Group, the IEEE 802.19 Coexistence Technical Advisory Group (TAG) and the National Fire Protection Association (NFPA) Panel 70, which maintains the National Electrical Code (NEC).

TR-41 takes a leadership role in providing support to the Administrative Council for Terminal Attachments (ACTA), both in terms of submitting technical criteria for ACTA adoption and by providing input on administrative matters. It also



maintains liaison with Industry Canada's Terminal Attachment Program Advisory Committee (TAPAC), and the Telecommunication Certification Body (TCB) Council. In addition, TR-41 provides input to Underwriters Laboratories (UL), the Canadian Standards Association (CSA), and International Telecommunication Union — Telecommunication Standardization Sector (ITU-T) Study Group 12, Performance and Quality of Service.

In support of TR-41's liaison relationships, Vice Chair Roger Britt has created a comparison table showing the relationships between voice transmission standards developed by several of the organizations noted above. This table has been found to be very useful by the relevant organizations and is available via the Voice Standards Comparison link on the TR-41 Web page (www.tiaonline.org/standards/sfg/tr-41).

Subcommittee TR-41.1, Telephony Aspects of MLTS and VoIP Equipment, sought during 2004 to broaden its scope to include telephony interface standards for VoIP gateways and terminal adapters. TR-41.1 began the year known as Multiline Terminal Systems and completed and published three documents. One was an addendum updating the loss plan information in TIA-464-C, *Requirements for PBX Switching Equipment*. The second was a joint effort with ETSI STQ resulting in TSB147, *Comparison of PBX Transmission Requirements* in Standards TIA-464-C and ETSI ES 201 168 Version 1.1. The third was TIA-594-B, *Synchronization Methods and Technical Requirements for Private Integrated Services Networks*.

After discussions to clearly delineate the differences between its work and that of TR-41.4, IP Telephony Infrastructures, TR-41 concurred in renaming TR-41.1 as Telephony Aspects of MLTS and VoIP Equipment. With a revised scope, TR-41.1's new name became "Multi-Line Telecommunications Systems (MLTS) and Analog/Digital telephony interfaces for Voice over Internet Protocol (VoIP) equipment," and the subcommittee embarked on two new projects: *1544 kbps Interface Requirements for Packet-Based Gateways* and *Analog Telephone Port Requirements for Packet-Based*

Stephen R. Whitesell

Chair, TR-41

Senior Technical Consultant - Standards
VTech Communications

Vice Chair:

Roger Britt
Nortel Networks



Terminal Adapters. A new **Working Group TR-41.1.1, Analog Telephone Port Requirements for Packet-Based Terminal Adapters**, was created to handle development of the latter document.

Subcommittee TR-41.3, Analog and Digital Wireline Terminals, neared completion of its effort to revise TIA-470-B, *Performance and Compatibility Requirements for Telephone Sets with Loop Signalling*. TR-41.3 decided to restructure the document into several subparts so it could easily update the parts as technology changes. Revision C of TIA-470 includes TIA-470.110-C, *Handset Acoustic Performance Requirements for Analog Telephones*, TIA-470.210-C, *Resistance and Impedance Performance Requirements for Analog Telephones*, and TIA-470.220-C, *Alerter Acoustic Output Performance Requirements for Analog Telephones*, which were completed and published in 2004. The single outstanding incomplete subpart is TIA-470.230-C, *Network Signaling Performance Requirements for Analog Telephones*, which is expected to be completed in early 2005. When all subparts are completed, TIA-470-B will be withdrawn. As a result of having completed their work, the **TR-41.3.5, Acoustics**, **41.3.6, Resistance and Impedance - 470C**, and **41.3.7, Alerter - 470C**, Working Groups were made inactive.

The new TIA-470-C, which used the content of TIA-470-B as its base, expanded its scope to cover several additional aspects of analog telephony as outlined in TIA-470.000-C, *Specifications Overview and Document Structure for Analog Wireline Telephones*. TIA-470.310-C, *Cordless Telephone Range Measurement Procedures*, was published as the first new document under this expanded scope. In addition, two new projects were initiated and two new working groups were created to handle them. **TR-41.3.10, Handsfree Acoustic Performance Requirements**, will be developing



Hands Free Acoustic Performance Requirements for Analog Telephones, and **TR-41.3.11, Headset Acoustic Performance Requirements for Analog Telephones**, will be developing *Headset Acoustic Performance Requirements for Analog Telephones*. In addition, **TR-41.3.3, VoIP and PCM Transmission Performance**, was reactivated to revise TIA-810-A, *Transmission Requirements for Narrowband Voice over IP and Voice over PCM Digital Wireline Telephones*.

In response to informal Federal Communications Commission (FCC) complaints about digital cordless telephones causing interference with hearing aids, TR-41.3 began work to characterize objectively the magnetic signal quality produced by cordless handsets for hearing aid coupling. The goal is to correlate the results with research work being conducted at Gallaudet University, relate objective measurements to subjective experiences of people who use hearing aids, and then develop performance criteria to be included in a voluntary industry standard.

Subcommittee TR-41.4, IP Telephony Infrastructures, completed its revision of *Voice Gateway Transmission Requirements*, which was published as TIA-912-A. TR-41.4 also made substantial progress on the revision of TIA/IS-811, *Performance and Interoperability Requirements for Voice-over-IP (VoIP) Feature Telephones*. The revised document should be approved in early 2005 and is much anticipated by the industry. Work also continued on the revision of TSB146, *IP Telephony Support for Emergency Calling Service*.

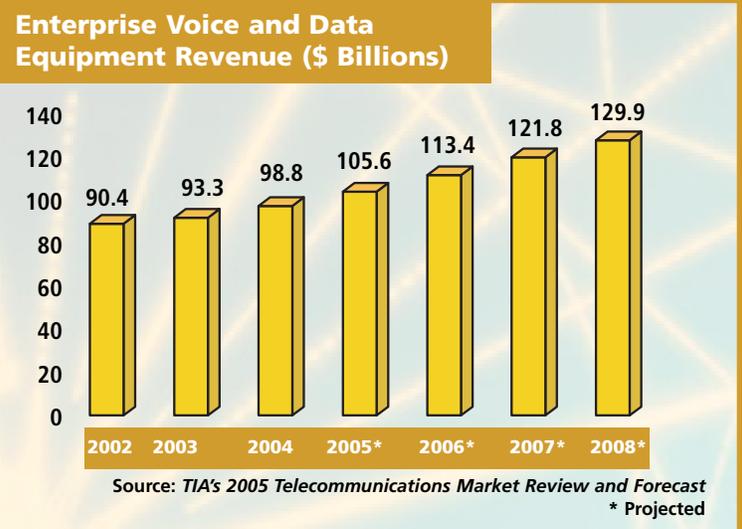
TR-41.4 initiated three new projects related to VoIP. A presentation about amendment 802.1ab, *Station and Media Access Control Connectivity Discovery*, being developed for the IEEE 802.1 LAN Management standard resulted in one of the new projects. Liaison was established with IEEE 802.1 and work was kicked off to develop a standard on *Link Level Discovery Protocol (LLDP) – Media Endpoint Discovery (MED)*. Among other things, LLDP-MED will facilitate locating VoIP telephones for E911 Emergency Calling Service. The two other new projects involve *Enterprise Location Information Server Interfaces* and *Technical*

Assessment of Synchronization Methods in IP Networks from a Quality of Experience Perspective.

Subcommittee TR-41.7, Environmental and Safety Considerations, has continued the effort to revise TIA-571-A, *Environmental Considerations*, in **TR-41.7.4, Environmental Considerations**. **TR-41.7.5, Telecommunications Overcurrent Surge Withstand**, is making progress in drafting a document on over-current protection devices used in telecom networks and terminal equipment. When completed, the document will be submitted to UL and CSA for their consideration in creating a safety standard for these components.

TR-41.7.1, Harmonization of International Safety Standards, noted a change in the specification of the wiring simulator used for power-cross testing in UL/CSA 60950-1, *Information Technology Equipment – Safety – Part 1: General Requirements*. However, the change was felt to be inconsistent with coordination requirements for protecting telephone line cords, and a recommendation was forwarded to the UL/CSA Bi-National Working Group to revert to previously used specifications for the wiring simulator. TR-41.7.1 is also monitoring developments related to receive acoustic limiting, hazardous material disposition and reports of exploding cell phone batteries.

Subcommittee TR-41.9, Technical and Administrative Regulatory Considerations, continued its FCC Part 68-related work of creating



updates to technical criteria for preventing harm to the network and submitting the documents to ACTA. The second addendum to TIA-968-A, *Technical Requirements for Connection of Terminal Equipment to the Telephone Network*, which made relatively minor technical corrections and clarifications, was approved by TIA and forwarded to ACTA for adoption. A third addendum to TIA-968 was created with strong liaison input from the ATIS T1E1.4 Digital Subscriber Loop (DSL) Access Working Group. This addendum provides network harms criteria for all spectrum management classes of DSL modems identified in T1.417-2003, *Spectrum Management for Loop Transmission Systems*. It was approved at the end of the year and submitted to ACTA for adoption.

TR-41.9.2, Test Methods, continued its efforts in revising TSB31-B, *Part 68 Rationale and Measurement Guidelines*. The updated document will include

suggested measurement methods for demonstrating compliance with all technical criteria in TIA-968-A and its addenda, as well as the criteria for terminal equipment retained by the FCC in its Part 68 rules.

TR-41.9 also provides industry responses to questions about TIA-968-A and Part 68. It maintains a list of Frequently Asked Questions (FAQs) and their answers on the TR-41 page (<http://www.tiaonline.org/standards/sfg/tr-41/faq.cfm>) on the TIA Web site.

SUBCOMMITTEES

TR-41.1 Telephony Aspects of MLTS and VoIP Equipment
Chair: Tailey Tung
Siemens Communications, Inc.
Vice Chair: François Pinier
Alcatel

TR-41.3 Analog and Digital Wireline Terminals
Chair: James Bress
AST Technology Labs Inc.
Vice Chair: Harry Van Zandt
ECS Technologies Inc.

TR-41.4 IP Telephony Infrastructures
Chair: Bob Bell
Cisco Systems Inc.
Vice Chair: Joanne McMillen
Avaya Inc.

TR-41.7 Environmental and Safety Considerations
Chair: Randy Ivans
Underwriters Laboratories
Vice Chair: Phillip Havens
Littelfuse L.P.

TR-41.9 Technical and Administrative Regulatory Considerations
Chair: Greg Slingerland
Mitel Networks
Vice Chair: Phillip Havens
Littelfuse L.P.



Engineering Committee TR-42 develops and maintains voluntary premises telecommunications systems requirements standards for copper and optical fiber cabling, pathways and spaces, administration, and related systems in commercial buildings, residential, industrial and other premises. The committee's standards work covers telecommunications cabling including component requirements, field-test and installation requirements, cabling distances, telecommunications outlet configurations, and recommended topologies.

TR-42's work addresses the requirements for the design and construction of telecommunications cabling systems for commercial buildings, single-family and multi-dwelling residential, data centers and industrial environments, including customer-owned outside plant. Telecommunications cabling systems includes the pathways into which telecommunications cabling is placed, as well as the rooms and areas associated with buildings and outside plant structures used to terminate cables and to install telecommunications equipment. The standards produced by TR-42 also apply to mobile homes, marine construction and other buildings to the extent practicable. TR-42 additionally formulates positions and proposals for harmonization with international standards bodies and maintains an ongoing liaison with application developers, such as the Institute of Electrical and Electronics Engineers (IEEE), and building cabling designers represented by BICSI.

The mega-gigabit era has introduced many new challenges for cabling, such as lower loss limits for optical fiber cabling and increasing frequency requirements for copper cabling. Global change in cabling requirements is occurring, and the latest documentation from TR-42, its subcommittees and working groups is evolving to meet the increased bandwidth demands of future applications. The activities of TR-42, along with its global influence on international standards, help increase trade and reduce costs for end-users. End-users must also keep abreast of these latest changes in technology to ensure making the right cabling systems decisions.

2004 Activities

The TR-42 Committee is organized into nine subcommittees and three working groups, each responsible for a specific area of premises telecommunications cabling needs.

TR-42's efforts covered a broad range of activities during 2004, including several additional expansions to the TIA/EIA-568-B, *Commercial Building Telecommunications Cabling Standard*,





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Fluke Networks

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NORDX/CDT

series of standards: TIA-568-B.1, *Commercial Building Telecommunications Cabling Standard; Part 1 General Requirements*, specifies general requirements for telecommunications cabling in commercial buildings; TIA-568-B.2, *Commercial Building Telecommunications Cabling Standard; Part 2 Balanced Twisted-pair Cabling Components*, specifies detailed requirements for copper cabling; and TIA-568-B.3, *Optical Fiber Cabling Components Standard*, specifies detailed requirements for optical fiber cabling.

The TIA/EIA-568-B series of standards continues to recognize balanced twisted-pair copper and optical fiber cabling and provides guidelines on cable selection and distance limits. Optical fiber is principally used for backbone cabling between buildings on a campus or between networking equipment on different floors of a building, and in addition is gaining interest and popularity for horizontal cabling. Laser-optimized fiber has been added to the optical fiber choice selections, which supports 10 Gb/s data transmission rates for distances up to 300 meters using serial data transmission and cost-effective Vertical Cavity Surface Emitting Lasers (VCSELs). Array connector polarity specifications are also being worked on for applications such as parallel optics for use in areas such as data centers. Balanced twisted-pair copper is used primarily for horizontal distribution between networking equipment in a telecommunications room or telecommunications enclosure and work area equipment, such as between a switch and a personal computer or telephone.

Category 6 cabling, which became a standard in June 2002, has had additional requirements approved as an addendum to ANSI/TIA/EIA-568-B.2. The bandwidth of copper cabling is being expanded as augmented category 6 cabling and is being developed within TR-42.7, attempting to reach up to 500 MHz. This

elevation in bandwidth is envisioned to continue copper cabling as the horizontal media of choice, as it will enable users to keep up with the growing demands of bandwidth-intensive networking. For example, the cabling system of optical fiber in the backbone and copper in the horizontal can aid the delivery of streaming video images for doctors to assist in operations from hospital to hospital.

ANSI/TIA 570-B, *Residential Telecommunications Infrastructure Standard*, has been published through the efforts of the **TR-42.2 Subcommittee, Residential Telecommunications Infrastructure**. Residential wiring has taken on growing importance as more homeowners take advantage of the benefits of digital convenience that can be obtained in their home, including home entertainment, home control systems, networking and telecommuting. The TIA-570-B standard completes the needs for homeowners, builders, installers and providers of Fiber-to-the-Premises (FTTP) and cable system in the home for networking, whole-home audio, security and control systems. For example, homeowners will be able to adjust the temperature in their home while driving home and then upon arriving at home adjust the lighting and bring up their favorite movie while turning down the home audio within the room, all from the comfort of their living room chairs.

Subcommittee TR-42.3, Commercial Building Telecommunications Pathways and Spaces, has completed TIA 569-B, *Commercial Building Standards for Telecommunications Pathways and Spaces*. This edition of the standard incorporates seven addenda that had previously been published and includes the criteria developed for multi-tenant buildings. Additionally, it specifies a new space called the telecommunications enclosure, which, when implemented in a network, could reduce owners' cost of cabling while increasing bandwidth to the end user. Architects, engineers and designers will use this standard as new and renovated buildings are planned for construction.

Subcommittee TR-42.8, Telecommunications Optical Fiber Cabling Systems, has published TIA TSB140, *Additional Guidelines for Field-Testing Length*,



Loss and Polarity of Optical Fiber Cabling Systems. This TSB provides information on how to test optical fiber cabling correctly as the loss budgets have continued to be reduced by application standards such as gigabit Ethernet.

TR-42 will continue to grow in scope and diversity with a focus on developing standards that can be used globally. At the subcommittee and working group level, there is an ongoing technical exchange and dialogue with international experts in the field of cable, connector and system performance and testing from the International Electrotechnical Commission (IEC) Technical Committee 46, "Cables, wires, waveguides, RF connectors, RF and microwave passive components," and Technical Committee 86, "Fibre optics." TR-42 has also been very active in providing input to

the Joint Technical Committee (JTC)-1, Subcommittee 25, "Interconnection of information technology equipment," WG3, "Customer premises cabling." The intent is to ensure that the TIA cabling standards are a technically compatible subset and fully harmonized with international standards.

In addition to the existing standards maintained by TR-42 and its subcommittees, new standards are also under development for industrial buildings and for data centers. The release of TIA-942, *Telecommunications Infrastructure Standard for Data Centers*, is anticipated because it addresses an industry need for the design, evaluation and implementation of data centers.

SUBCOMMITTEES

- | | |
|--|---|
| <p>TR-42.1 Commercial Building
Telecommunications Cabling
Chair: Herb Congdon
Tyco Electronics
Vice Chair: Julie Roy
NORDX/CDT</p> | <p>TR-42.6 Telecommunications Infrastructure
Administration
Chair: Peter Sharp
Giffels Associates
Vice Chair: Steve Huffaker
BankOne</p> |
| <p>TR-42.2 Residential Telecommunications
Infrastructure
Chair: Bob Jensen
Fluke Networks
Vice Chair: John Pryma
Genesis Cable</p> | <p>TR-42.7 Telecommunications Copper Cabling
Systems
Chair: Paul Vaanderlaan
Belden Wire and Cable
Vice Chair: Valerie Rybinski
Hitachi Cable Manchester</p> |
| <p>TR-42.3 Commercial Building
Telecommunications Pathways and
Spaces
Chair: Steve Huffaker
BankOne
Vice Chair: Glenn Sexton
Northwest Information Services</p> | <p>TR-42.8 Telecommunications Optical Fiber
Cabling Systems
Chair: Herb Congdon
Tyco Electronics
Vice Chair: Julie Roy
NORDX/CDT</p> |
| <p>TR-42.4 Outside Plant Telecommunications
Infrastructure
Chair: Henry Franc
Bell Canada</p> | <p>TR-42.9 Industrial Telecommunications
Infrastructure
Chair: Shadi AbuGhazaleh
Hubbell Premise Wiring
Vice Chair: Bob Lounsbury
ODVA Rockwell</p> |
| <p>TR-42.5 Telecommunications Infrastructure Terms
Chair: Peter Sharp
Giffels Associates
Vice Chair: Steve Huffaker
BankOne</p> | |



Engineering Committee TR-45 develops performance, compatibility, interoperability and service standards for mobile and personal communications systems. These standards pertain to, but are not restricted to, service information, wireless terminal equipment, wireless base station equipment, wireless switching office equipment, ancillary apparatus, auxiliary applications, internetwork and intersystem operations, and interfaces.

2004 Activities

TR-45 is comprised of six subcommittees and a number of standing ad hoc groups, which focus on various aspects of wireless mobile and personal communications systems (PCS) specifications and standards. In addition to maintaining and enhancing standards for the second generation of cellular and PCS, the committee continues to support the International Telecommunication Union (ITU) with inputs to the International Mobile Telecommunications (IMT)-2000 Recommendations that form the basis of third-generation (3G) services for wireless worldwide and inputs to the working documents towards systems beyond IMT-2000.

Committee TR-45 and its subcommittees published many key standards and Telecommunications Systems Bulletins (TSBs) that provide the basis of the mobile infrastructure for several radio interfaces. In addition to the many publications, several key decisions and initiatives were undertaken by the committee in 2004.

- Revisions were made to the committee, subcommittees, and ad-hoc groups scopes and charters.
 - Electronic surveillance work within the committee was restructured so TR-45 addresses higher-level issues, while

Subcommittee TR-45.2, Core Network Technology, was chartered to develop electronic surveillance standards for the Internet Protocol (IP) Multimedia Subsystem/ Multi-Media Domain (IMS/MMD), and **Subcommittee TR-45.6, Telecommunications Infrastructure Administration**, was chartered to develop standards relative to cdma2000[®] packet data network technologies, since these are the subcommittees at which the subject matter experts (SMEs) are normally in attendance.

- TR-45.2 took on the assignment to be the lead group for Next-Generation Network (NGN) work within TR-45 and to coordinate with the other subcommittees and ad-hoc groups on NGN. In coordination with Third Generation Partnership Project 2 (3GPP2), TR-45 has produced documents to

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Cheryl J. Blum

Chair, TR-45

Lucent Technologies Inc.

Vice Chair:

Gerry Flynn

Verizon Wireless



support NGN (IMS/MMD) architecture and framework and continues to work on convergence via 3GPP2 and Third Generation Partnership Project (3GPP). Furthermore, the NGN work also supports convergence relative to Lawfully Authorized Electronic Surveillance (LAES) and Enhanced 911 (E911).

- The Equipment Serial Number (ESN)/Universal Identification Module ID (UIM)/Mobile Equipment Identifier (MEID) Ad Hoc Group has been extremely active in addressing ESN exhaust and MEID migration and transition issues and in raising industry awareness on the impacts of this transition.
- Standards work applicable to the principles of Project MESA (Mobility for Emergency and Safety Applications) and to the needs of public safety were identified by the subcommittee with company contributions submitted at the October 2004 Project MESA meeting, regarding cdma2000® as a technology solution for Project MESA.
- The committee continues to actively support the Global Standards Collaboration (GSC). Within TR-45, groups prepared several contributions that were presented at the GSC-9 conference held in May 2004.
- New leaders were elected and confirmed in a number of the subcommittees' and ad-hoc groups' chair and vice chair positions.

Highlights of these and numerous other projects, publications, and activities of the subcommittees and ad hoc groups are described below.

Subcommittee TR-45.1, Analog Technology, was rendered dormant in December 2003. Outstanding TR-45.1 work and work related to analog technology projects were handled on the Committee TR-45 level as necessary.

Subcommittee TR-45.2, Core Network

Technology, adopted a new name in 2004 to reflect the broad support it provides for different radio interfaces within TR-45 and took on the assignment to be the lead group for Next-Generation Networks (NGN) within TR-45 and to coordinate with the other subcommittees and ad-hoc groups on NGN initiatives. As a result of the TR-45 restructure of the electronic surveillance work within Committee TR-45, TR-45.2 was chartered to develop electronic surveillance standards for the IMS/MMD, while TR-45.6 was chartered to develop standards relative to cdma2000® packet data network technologies. TR-45 looks to TIA to address higher-level legal regulatory issues.

During the year, TR-45.2 approved over 30 standards for publication. The majority of the publications (20) were the multiple documents comprising TIA-41.xxx, *Wireless Radiotelecommunications Intersystem Operations, Revision E* (where xxx represents Parts 790, 750, 730, 700, 590, 551, 550, 540, 520, 512, 511, 510, 500, 100). Other key standards published by TR-45.2 in 2004 were:

- TIA-872-A, *3GPP2 All-IP Core Network Enhancements for Legacy MS Domain – Step-1*
- TIA-881, *TIA/EIA-41-D Location Services Enhancements*
- J-STD-038-B, *GSM and TIA-41 Network Interworking*
- TIA-928, *TIA/EIA-41 Support for the Mobile Equipment Identity (MEID)*
- TIA-843, *Wireless Intelligent Network Support for Location Based Services*
- TIA-847-B, *Roamer Database Verification*



- TIA-1032.xxx, *Presence Service: Architecture and Functional Description*, (where xxx represents Parts 000, 001)
- TIA-917, *Wireless Priority Service Enhancements for CDMA Systems*
- TIA-934-xxx-B, *Multimedia Messaging System Specification (MMS) MM3 Stage 3 for Internet Mail Exchange*, (where xxx stands for Parts 000-B-1, 200-1, 310-1, 312, 330, 340-1 and 370-1)

Continuing to work closely with 3GPP2 TSG-X, Core Networks, some of the new projects in TR-45.2 include enhancements to TIA-41 in order to support Wireless Local Area Network (WLAN) interworking, addendum to MEID support (decimal format), conferencing using the Internet Protocol (IP) Multimedia (IM) Core Network (CN) subsystem: stage 3.

Subcommittee TR-45.3, Time Division Digital Technology, has pursued work on ANSI/TIA-136 Revision F since the publication of the multiple documents comprising ANSI/TIA-136, *TDMA Third Generation Wireless*, Revision E in January 2004. In addition, numerous parts of ANSI/TIA-136 have recently been through reaffirmation ballot resolution and are also pending publication. In the near future, reaffirmation of other ANSI/TIA-136 parts will be required. Looking at the TIA-136 series as a whole, in 2004 TR-45.3 approved over 30 standards documents for publication.

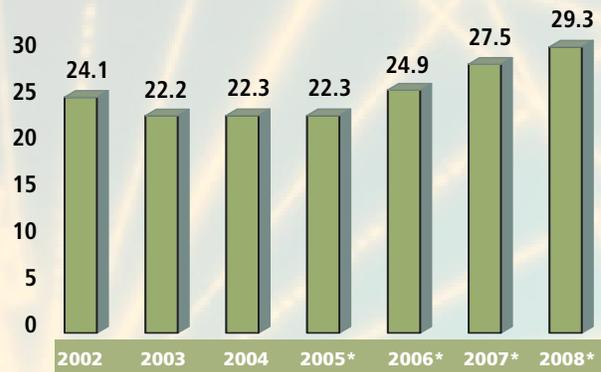
TR-45.3 continued to work jointly with the Alliance for Telecommunications Industry Solutions (ATIS) Wireless Technologies and Systems Committee (WTSC) (formerly Committee T1P1) on providing input to ITU-Radiocommunication Sector (ITU-R) Working Party 8F “IMT-2000 and systems beyond IMT-2000” for Time Division Multiple Access (TDMA)-Single Carrier (SC) in ITU-R Recommendation M.1457-4, *Detailed Specifications of the Radio Interfaces of IMT-2000*. TR-45.3 adopted the update package with the relevant global core specifications for

TDMA-SC that was conveyed to WP8F via TIA well before the October 2004 deadline. The workplan for TR-45.3 for 2005 includes preparing Revision F of TIA-136, with a tentative ballot date in first quarter of 2005. Additionally, work proceeds on providing the next TDMA-SC update to WP8F working cooperatively with ATIS WTSC on the next update package due for ITU-R M.1457-5 in May 2005.

Subcommittee TR-45.4, Radio to Switching Technology, most recently approved the

Interoperability Specifications (IOS) v5.0 standard for publication. Many features were added to this revision of the standard, such as support of Reverse Packet Data Channel (R-PDCH) (1xEV-DV) enhancements; support of MEID; Transcoder Free Operation (TrFO); remote Transcoder Operation (RTO); packetized A1p/A2p interfaces; voice Preference Over Packet (VPOP); enhancement to the Packet Data Serving Node (PDSN) selection algorithm; circuit-switched video conferencing calls; and wideband speech codec. In November 2004, TIA-2006, the *IOS for Broadcast Multicast Services (BCMCS)* standard was approved for publication. In addition, TIA-1070, the *IOS for Hybrid MS/AT (HAT) Authentication* standard, was approved for publication in December 2004. Several projects are under way in TR-45.4, in conjunction with 3GPP2 TSG-A, Access Network Interfaces. Among these projects are Support for High-Rate Packet Data (HRPD) Air Interface in Revision A (i.e., TIA-878-A and TIA-1878-A [IOS HRPD]),

U.S. Wireless Equipment Revenue (\$ Billions)



Source: TIA's 2005 Telecommunications Market Review and Forecast
* Projected



development of requirements for IOS v5.1 and other enhancements to IOS HRPD.

Subcommittee TR-45.5, Spread Spectrum Digital Technology, continues to be the industry leader in the publication of standards for 3G cdma2000® technology. The family of cdma2000®-related standards is composed of nearly 150 standards, many of which were approved for publication in 2004. TR-45.5 is particularly proud to announce the publication of Revision E, as well as Revision D, of the TIA-2000 series of standards and related standards. The multi-part Revision E standard includes, but is not limited to, the following publications.

- TIA/EIA/IS-2000.1-C-1, *Introduction to cdma2000® Spread Spectrum Systems, Addendum 1*;
- TIA/EIA/IS-2000.2-C-1 through TIA/EIA/IS-2000.6-C-1;
- TIA-864-1, *Recommended Minimum Performance Standards for cdma2000® High Rate Packet Data Access Network Equipment, Addendum 1*;
- TIA-866-1, *Recommended Minimum Performance Standards for cdma2000® High Rate Packet Data Access Terminal, Addendum 1*;
- TIA-856-2, *cdma2000® High Rate Packet Data Air Interface Specification, Addendum 2*;
- TIA-97-E-1, *Base Station Performance Standards for Dual Mode Spread Spectrum Systems*;
- TIA-820-A-1, *Removable User Identity Module for Spread Spectrum Systems, Addendum 1*;
- TIA-2000.1-C-1, *Introduction to cdma2000® Spread Spectrum Systems, Enhanced Addendum 1*;
- TIA-2000.2-C-1 through TIA-2000.6-C-1.

In addition to the standards listed above, many other standards were approved for publication by TR-45.5. TR-45.5 submitted the biennial updates for CDMA Multi-Carrier (MC) for Revision 5 of the

ITU-R Recommendation M.1457 to the ITU via TIA. TR-45.5 continues to work in conjunction with the 3GPP2 TSG-C in the development of the pre-standard specifications. Examples of works in progress include: Removable User Identity Module (R-UIM)/Mobile Equipment (ME) Locking Mechanism for cdma2000® Spread Spectrum Systems (PN-3-0110); Multimedia Streaming Service (MSS) for cdma2000® Spread Spectrum Systems (PN-3-0113); High-Rate Packet Data Supplemental Packet Data Services (PN 3-0181); Multimedia Messaging Service Media Formats and Codecs for cdma2000® Spread Spectrum Systems (PN-3-0112-AD1); Removable User Identity Module for Spread Spectrum Systems (PN-3-4690-RV1-AD2).

Subcommittee TR-45.6, cdma2000® Wireless Packet Data Technology, adopted a new name and enhanced charter in 2004. In general, TR-45.6 is charged with developing performance, compatibility and inter-operability standards for equipment that supports wireless packet data services, which may be deployed as an integral part of a cdma2000® system. As noted above, as a result of the TR-45 restructure of the electronic surveillance work within Committee TR-45, TR-45.6 was chartered to develop standards relative to cdma2000® packet data network technologies, while TR-45.2 was chartered to develop electronic surveillance standards for the IMS/MMD. TR-45 looks to TIA to address higher-level legal regulatory issues.

The projects under way in TR-45.6 include the cdma2000® *Wireless IP Network* standard development; LAES for VoIP; cdma 2000® Broadcast and Multicast Services (BCMCS); WLAN Interworking; CDMA/GPRS (General Packet Radio Service) Data Roaming; and LAES for Push-to-talk over Cellular. Publication of TIA-835-B-1, as a supplement to the cdma2000®, *Wireless IP Network* standard, late in 2004 was the culmination of the publication of standards by TR-45.6 in 2004.

The TR-45 Ad Hoc Authentication Group (AHAG) continued to develop drafts of procedures and conduct reviews of requirements related to a number of security- and authentication-related topics and



issues. The *Enhanced Cryptographic Algorithms* developed by the AHAG was published as TIA-946 in June 2004. The *Broadcast-Multicast Service Security Framework*, published as TIA-1053, was based on work in 3GPP2 TSG-S, Service and System Aspects, Working Group 4, Security, supported by the AHAG. In addition to its support of TR-45 and its subcommittees, the TR-45 AHAG continues to work closely with 3GPP2 TSG-S Working Group 4, as well as to coordinate with 3GPP TSG-SA, Services and Systems Aspects, Working Group 3, Security. The current SA3 and AHAG joint control agreement for Authentication and Key Agreement (AKA) remains valid. TR-45 endorsed the AHAG request to establish a liaison with the Open Mobile Alliance (OMA) security work. Another example of AHAG support of other organizations includes the AHAG-developed draft liaison to ITU-T on management plane security, using inputs provided by 3GPP2 TSG-S WG4. Under way is the AHAG work on a new ANS Addendum, TIA-946-1 for *Enhanced Cryptographic Algorithms, Addendum 1*, to address minor problems identified by 3GPP2

The **TR-45 Equipment Serial Number (ESN)/Universal Identification Module ID (UIM)/Mobile Equipment Identifier (MEID) Ad Hoc Group (EUMAG)** continues to support TIA on global numbering issues and administrative initiatives. This ad hoc group has led the industry by providing recommendations on topics of utmost importance to the industry, including ESN manufacturer codes, ESN reclamation, ESN re-use, ESN administration, UIM ID manufacturer codes, UIM administration, MEID GHA (global hexadecimal administration) and MEID guidelines. The ad hoc group continues to serve as editor of the TIA *ESN Assignment Guidelines and Procedures* and of the *MEID GHA Assignment Guidelines and Procedures*.

The two primary issues addressed by the ESN/UIM/MEID ad hoc group during 2004 were first, ESN exhaust and reclamation, and second, UIM ID designation. The ad hoc group worked closely with the ESN and UIM ID Administrators to maintain the assignment guidance plan and discuss ESN assignment with UIM IDs derived from ESNs, paying particular

attention to the distribution sequence in anticipation of ESN exhaust. As a leader in the industry, the ad hoc group has educated the industry through outreach awareness programs in the management of the ESN exhaust timeline and transition to MEID. The expected timeframe for ESN exhaust been extended due to the extraordinary conservation efforts of the EUMAG.

The ESN/UIM/MEID ad hoc group continues to work in conjunction with 3GPP2 on MEID and on other topics related to global numbering according to the direction of TR-45. TIA has posted the ESN and MEID documents developed by the ad hoc and related information on the TIA Web site at www.tiaonline.org/standards/esn (including a Frequently Asked Questions Sheet, the ESN Migration to MEID Milestones and a Timeline document.)

The **TR-45 Lawfully Authorized Electronic Surveillance (LAES) Ad Hoc Group** completed for publication the TIA standard J-STD-025-B on *Lawfully Authorized Electronic Surveillance*. The LAES is working closely with ATIS to coordinate balloting of the next ANS revision of the *Lawfully Authorized Electronic Surveillance* standard, namely the ANSI version of J-STD-025-B. After the public review ballots as an American National Standard (ANS) are completed, the J-STD-025 series of standards will be capped at Revision B.

A significant decision was reached by Committee TR-45 to restructure the work on electronic surveillance. The additional electronic surveillance capabilities, particularly those beyond the mandates of the *Communications Assistance for Law Enforcement Act (CALEA)*, will be distributed between Subcommittee TR-45.2 and Subcommittee TR-45.6 to focus the work where most of the subject matter experts are normally in attendance such that Subcommittee TR-45.2 would develop the standards relative to IMS and Subcommittee TR-45.6 would develop the standards relative to the cdma2000[®] packet data network technologies.

The **TR-45 Ad Hoc Group on Electronic Media Documentation (AHM)** continues to investigate



SUBCOMMITTEES

TR-45.1	Analog Technology Inactive	TR-45	Ad Hoc Authentication Group (AHAG) Chair: Frank Quick QUALCOMM
TR-45.2	Core Network Technology Chair: David Crowe QUALCOMM	TR-45	Ad Hoc Group on Lawfully Authorized Electronic Surveillance (LAES) Chair: Terri Brooks Terri Brooks Consulting
TR-45.3	Time Division Digital Technology Chair: Peter Musgrove AT&T Wireless Services	TR-45	Ad Hoc Group on UIM/ESN/MEID Chair: Gary Pellegrino CommFlow Resources
TR-45.4	Radio to Switching Technology Chair: George Turnipseed Sprint	TR-45	Network Architecture Ad Hoc Group (NAG) Inactive
TR-45.5	Spread Spectrum Digital Technology Chair: Jean Alphonse Lucent Technologies Inc.	TR-45	Ad Hoc on Electronic Media Documentation (AHM) Chair: Peter Nurse Lucent Technologies Inc.
TR-45.6	cdma2000® Packet Data Technology Chair: Parviz Yegani Cisco Systems		

and recommend the use of electronic methods to support the work of Committee TR-45. Electronic methods proposed by the AHM during 2004 include a Web-based calendar, an electronic database of contributions, Internet access at meetings, and electronic sign-in at meetings.

The **TR-45 Network Architecture Ad Hoc Group (NAG)** remains dormant. Consequently, the project related to the Network Reference Model (NRM), historically under the purview of the NAG, was addressed by Committee TR-45 during 2004. The *IP Network Reference Model (NRM) for cdma2000 Spread Spectrum Systems* to be published as TIA/TSB151-A was approved for ballot in late 2004. Publication of TSB151-A is anticipated in early 2005.



The FO-4 Engineering Committee on Fiber Optics is responsible for the development and maintenance of fiber optic component and system technology standards. These standards are intended to be employed by users and suppliers of fiber optic communications technology to promote compatible and interoperable systems used to support a wide variety of voice, data, video and telemetry applications for trade and commerce. To this end, the FO-4 Engineering Committee works closely with other national and international standards development organizations in promoting harmonization and ease of use for worldwide fiber optic technology deployment.

The FO-4 Engineering Committee focuses primarily on fiber optics standards for:

- Testing methodologies for passive and active components, subsystems and systems
- Metrology and calibration
- Interface standards
- Component and system specifications
- Performance and reliability
 - System design guides
- Terminology and symbology

The FO-4 Engineering Committee is comprised of five subcommittees and eight working groups covering a wide range of fiber optic standardization subjects.

2004 Overview

The structure of FO-4 was streamlined in 2003 to allow maximum participation. During 2004, there was an increase in attendance, and much work was accomplished in the fiber optic standardization arena. The meetings were attended by participants of the subcommittees and working groups, as well as by the International Electrotechnical Commission (IEC) Technical Advisory Groups (TAGs) to IEC Technical Committee (TC) 86, Fibre Optics.

The committee takes an interest in the ongoing activities of both domestic and international standards organizations and continued to establish liaisons with organizations having mutual concerns. In North America, these included the Alliance for Telecommunications Industry Solutions (ATIS), the Institute of Electrical and Electronics Engineers (IEEE), the Insulated Cable Engineers Association (ICEA), the National Electronics Manufacturing Initiative (NEMI), and the Institute of Interconnecting and Packaging Electronic Circuits (IPC) Optoelectronic Packaging.

Internationally, FO-4 developed several technical contributions in support of work in the International Telecommunication Union – Telecommunication Standardization Sector (ITU-T). The committee also participated in the



Steven E. Swanson

Chair, FO-4

Manager, Standards Engineering
Corning Inc.



relevant TAGs of the International Organization for Standardization (ISO) and the IEC including:

- IEC TC 86 and its subcommittees;
 - Subcommittee 86A, Fibre and Cables;
 - Subcommittee 86B, Fibre Optic Interconnecting Devices;
 - Subcommittee 86C, Fibre Optic Systems and Active Devices; and
- ISO/IEC Joint Technical Committee 1/SC25 on Interconnection of Information Technology Equipment.

Key Developments in 2004

Elections were held for the committee and all subcommittee leadership positions in January 2004.

Formal discussion began on the standards needs for FTTx (Fiber-to-the-xxx). There are many areas where fiber is being explored to deliver broadband such as Fiber-to-the-Premises (FTTP), Fiber-to-the-Building (FTTB), Fiber-to-the-Home (FTTH), and Fiber-to-the-User (FTTU).

FO-4 established a reliability coordination task group to:

- Develop guidelines on the translation of system reliability requirements into discrete system elements.
- Develop reliability guidelines (assessment procedures, parameters and their associated definitions) and requirements.
- Review and coordinate reliability needs, activities and requirements.

FO-4 established a correspondence group to develop recommendations on multimode launch conditions.

TIA balloted the following ICEA Fiber Cable Standards for adoption as American National Standards:

- ICEA S-596, *Indoor Cable*
- ICEA S-640, *OSP Cable*
- ICEA S-696, *Indoor/Outdoor Cable*
- ICEA S-717, *Drop Cable*

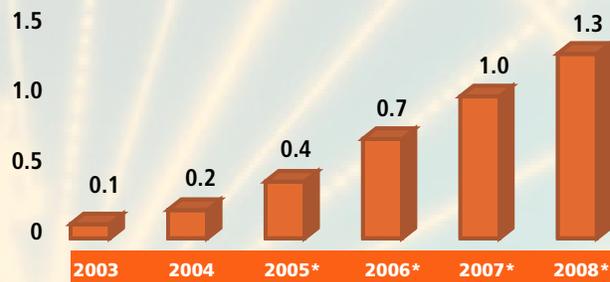
The FO-4 Engineering Committee published the following new documents in 2004:

- TSB62-24, *Fiber Break Source Analysis*
- TIA-604-17, *Fiber Optic Connector Intermateability Standard, Type MU*

The FO-4 Engineering Committee revised the following standards in 2004:

- TIA-440-B, *Fiber Optic Terminology*
- TIA-455-124A, *Polarization-Mode Dispersion Measurement for Single-Mode Optical Fibers by Interferometry*
- TIA-604-2B, *Fiber Optic Connector Intermateability Standard, Type ST*
- TIA-604-3B, *Fiber Optic Connector Intermateability Standard, Type SC and SC-APC*

Fiber to the Home Subscribers (Millions)



Source: TIA's 2005 Telecommunications Market Review and Forecast
* Projected



- TIA-604-4B, *Fiber Optic Connector Intermateability Standard, Type FC and FC-APC*
- TIA-604-13A, *Fiber Optic Connector Intermateability Standard, Type SFOC 1.25*
- TIA-604-16A, *Fiber Optic Connector Intermateability Standard, Type LSH*

In addition, FO-4 is committed to worldwide harmonization of fiber optic standards and continues to nationally adopt IEC published standards where possible. Back-adoption of IEC standards allows manufacturers to use the same standard worldwide to produce product in a uniform method. IEC standards can be adopted nationally without any change or they can be adopted with some regional variation.

In 2004, the following standards were back-adopted by FO-4 directly from IEC Standards to TIA American National Standards:

- IEC 61282-5, *Fibre Optic Communication System Design Guides — Part 5: Accommodation and*

- | | |
|---------------|---|
| FO-4.1 | Fiber Optic Systems
Chair: James Matthews III
Corning Inc. |
| FO-4.2 | Optical Fibers and Cables
Chair: Tom Hanson
Corning Inc. |
| FO-4.3 | Interconnecting Devices and Passive Components
Co-Chairs: Tom Ball, OFS;
Andre Girard, EXFO Electro-Optical
Engineering Inc. |
| FO-4.4 | Fiber Optic Amplified Systems, Active
Components and Reliability
Chair: Pin Su
Dicon Fiberoptics Inc. |
| FO-4.5 | Fiber Optic Metrology
Chair: Lorenz Cartellieri
Experior Photonics Inc. |

Carrier Spending on Fiber (\$ Billions)



Source: TIA's 2005 Telecommunications Market Review and Forecast
* Projected

Compensation of Dispersion nationally adopted as TIA/TR-1026

- IEC 60793-1-46, *Optical Fibres — Part 1-46: Measurement Methods and Test Procedures — Monitoring of Changes in Optical Transmittance* nationally adopted as TIA-455-20B
- IEC 61280-2-8, *Fiber Optic Communication Subsystem Test Procedures Part 2-8: Digital Systems — Determination of Low BER Using Q-Factor Measurements* nationally adopted as TIA-455-235
- IEC 61280-2-9, *Fibre Optic Communication Subsystem Test Procedures Part 2-9: Digital Systems — Optical Signal-to-Noise Ratio Measurement for Dense Wavelength-Division Multiplexed Systems* nationally adopted as TIA-455-236

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National Air and Space Administration (NASA)
National Communications System (NCS)
National Institute of Standards and Technology
(NIST)



National Telecommunications and Information Administration (NTIA)

New York State Office for Technology

Royal Canadian Mounted Police

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U.S. Department of Defense

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U.S. Department Navy

U.S. Forest Service

U.S. General Accounting Office

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State of Georgia

OTHER ENTITIES

Association of Public Safety Communications Officials (APCO)

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Gallaudet University

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Institute of Electrical and Electronics Engineers (IEEE)

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TIA represents the communications sector
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