




# Standards *and* Technology

star

Annual Report 2001 »



*“Clear, unimpeded, immediate  
‘interoperable’ communications are vital  
to the success of public safety personnel  
in saving lives and safeguarding property ...  
Interoperability of public safety wireless  
communications systems is an issue that  
affects everyone in the nation.”*

PSWN Standards Awareness Guide (2001)

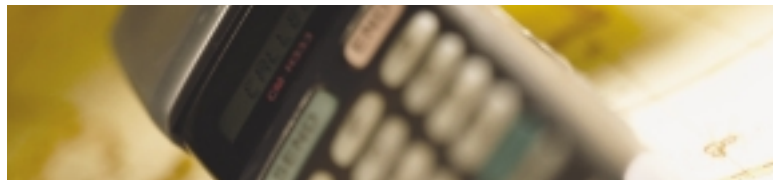
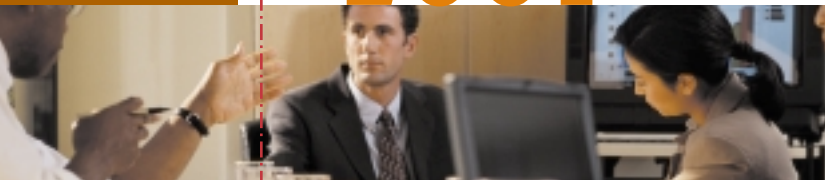
*The purpose of the Communications Act and the FCC is  
“to make available, so far as possible, to all the people  
of the United States ... a rapid, efficient, nationwide  
and worldwide telecommunications service ... for the  
purpose of the national defense, for the purpose of  
promoting safety of life and property through the use  
of wire and radio communication.”*

Telecommunications Act of 1934  
(as amended 1996)

*“An effective, hardened and redundant  
public safety communications infrastructure  
is an essential component of our way of  
life. This comes at no small cost; but  
anything less could leave us insufficiently  
prepared in the times that reliable  
communications are most needed.”*

Tom Sugrue, Wireless Telecommunications Bureau Chief,  
FCC (November 16, 2001)

# 2001



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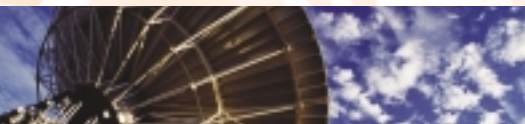
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I am writing to you in my first year as chairman of the TIA Board of Directors. And what a year it was. The first part of the year was somewhat upbeat. Many records were established at TIA: greatest number of employees serving TIA members; largest square footage of office space rented; most number of diverse services offered to members; largest number of exhibitors and square footage at SUPERCOMM 2001; and successful launch of the first SUPERnet exhibition in Silicon Valley.

Many of our TIA members and others in the industry did not fare as well — some unenviable records there include: the largest drop in shareholder value in a decade, first time personnel layoffs by many of our new members, as well as significant layoffs and plant closings by long-standing industry giants. Even my company, a small TIA member, was faced with layoffs and plant closing.

The industry is still going through tough times as I write this.

TIA, its members and those who participate in TIA programs like standards development are fortunate due to all of the TIA staff keeping expenses under control for the year, coupled with strong earnings from SUPERnet, SUPERCOMM, standards sales and only slightly reduced dues income.

The economic picture for the telecommunications industry is mixed. Many believe the upturn is months away. The economy, including the communications equipment industry, had been showing signs of turning around prior to September 11. The decline in investment spending in the first half of 2001, which was widely interpreted as leading the economy into a recession, was actually paving the way for the recovery, according to the *2001 MultiMedia Telecommunications Market Review and Forecast Third Quarter Supplement*. With the events of September 11, recovery was brought to an abrupt halt. The *Market Review and Forecast* now projects telecom investment spending to grow again in 2003.

In spite of the economy, however, standards production at TIA remained strong. Our industry needs standards for interoperability and reliability. Standards are a number one priority at TIA. The 2001 Board Goals focused on our standards activities were:

■ *In its role as Secretariat to the Third Generation Partnership Project 2, provide cost-efficient services, timely handling of all tasks, and support TIA members, Engineering Committee participants, and other international Organizational Partners and their members in the evolution of the International Telecommunication Union's IMT-2000 initiative.*

I am advised this goal was achieved with all assigned tasks accomplished, prudent fiscal control and management of resources well under budget, and timely delivery of docu-

## Letter from the Chairman

ments to the standards development organizations (SDOs) and the ITU.

■ *In furtherance of the TIA Board's "e-Association" initiative, apply information technology (IT) solutions in use on the technical side of TIA, as appropriate, to TIA's other operations while at the same time upgrading and enhancing TIA's IT capabilities with new and emerging technologies.*

As you will note elsewhere in this issue of the *Standards and Technology Annual Report (STAR)* as well as the *TIA 2001 Annual Report*, the association has gotten more adept at use of technology to do its work smarter, faster, better and more economically.

■ *Continue domestic efforts at improving the standards development process and shortening the intervals for standards development via use of new and emerging technologies for Web-based collaboration, and apply these same approaches to TIA's International Electrotechnical Commission Secretariat and Technical Advisory Group administration services.*

TIA staff continues to work to shorten not only TIA intervals for standards development, but also those intervals controlled by others such as the American National Standards Institute (ANSI). TIA joined with other standards development organizations to have ANSI shorten its "Standards Action" intervals and the time it takes ANSI staff to generate *Standards Action*. Jim Romlein, the chair of our Technical Committee, demonstrated to other SDOs in Sydney, Australia, how webcasting and video streaming could be used effectively in standards development. TIA and the European Telecommunications Standards Institute also used webcasting for Project MESA — Mobility for Emergency and Safety Applications — post-9/11 when travel was being curtailed.

The purpose of *STAR* is to update you on developments during the year, note what is planned for the future, and thank the volunteers and their companies for supporting our world-class standards development program. As chairman of the TIA Board, I thank you all for your efforts.

Sincerely,

Edward Kientz



## Letter from the President



I want to welcome readers to another edition of the Standards and Technology Annual Report (STAR). As the TIA Chairman has noted, the year 2001 was turbulent and saw much change both for TIA and its members. The association started the year with the new structure requested by its Board of

Directors. New departments had been created and they each have corresponding Board Committees to provide guidance and oversight.

From a standards perspective, we consolidated all staff serving our Engineering Committees, TIA Secretariat, Global Standards and Technology, International Electrotechnical Commission Secretariats and Technical Advisory Groups, and Third Generation Partnership Project 2 (3GPP2), under Dan Bart. Dan was also given several special projects. Under one project called the “e-Association” initiative, TIA has upgraded the hardware, software, infrastructure and applications used at TIA to provide better, faster and more efficient member services. Our e-Association focus in 2001 was internal; in 2002 we are going to be more externally focused and pursue new electronic member services.

Our 2001 standards program again continued at a healthy pace. As noted by the Technical Committee Chair, our number of deliverables was unabated by the economic conditions in the industry.

Standards have always ranked as a top priority at TIA by the Board and by TIA members. Although sales of TIA member products greatly declined during 2001, I am pleased to say the same was not true on the sales of TIA standards. We continued to provide necessary documents for the industry and demand continued as strong as ever. Royalties from the sales of TIA standards and related documents help to offset some of the costs of our standards program. During 2001 we continued the two partnership programs in which TIA is involved — 3GPP2 and the Public Safety Partnership Project (PSPP) or MESA (Mobility for Emergency and Safety Application) — and renewed our cooperation agreement with the European

Telecommunications Standards Institute for another three years. We also signed a cooperation agreement with the Inter-American Telecommunication Commission, an agency under the Organization for American States, which provides for cooperation in the area of standards as well as market development.

I provided an update on the state of standardization in telecommunications during the World Electronics Forum (WEF) meeting in November in Brazil.

TIA also continues to advocate the importance of standards globally with outreach efforts to U.S. Commercial Service and State Department personnel.

STAR is one way we highlight the work of the standards program at TIA and also to say thank you to the many volunteers who help develop TIA standards and the companies that support them. Thank you for another productive year.

Sincerely,

Matthew J. Flanigan

*I am writing to you as my tenure as Chair of the TIA Technical Committee comes to a close. My sixth year as a TIA Board member ended on December 31, 2001, and the office of Technical Committee Chair will pass to another Board member. I wish the new Chair well on his or her endeavors.*

The Technical Committee met twice in 2001, in May and September. The Technical Standards Subcommittee (TSSC) did not have any face-to-face meetings, instead carrying on its work electronically. A meeting of the Technical Committee is set for March 8, 2002, in Vancouver, B.C. In addition, that meeting will be webcast and some participants will also be located at TIA headquarters in Arlington, Virginia, and elsewhere. TIA has been experimenting with and using web-conferencing and webcasting more and more this year, especially as economic conditions have led to a decrease in participants' abilities to travel.

As Technical Committee Chair, I was able to participate on the TIA delegation to the Global Standards Collaboration/RADio STandardization (GSC7/RAST10) meetings in Sydney, Australia in November. GSC/RAST are meetings of major telecommunications standards bodies worldwide to discuss and collaborate on global standards topics or high interest subjects. I was also able to participate in the GSC Electronic Working Group and demonstrate how video streaming can be used to facilitate standards development. Many TIA programs were supported during these meeting by the other standards developers and new high interest subjects will also be pursued on a bilateral basis among the participants. For more information on these meetings, go to [www.acif.org.au](http://www.acif.org.au).

Standards production and processing continued at an elevated pace this year, and the economy did not slow down TIA standards development for the industry. The staff handled requests to create/revise/reaffirm/withdraw 130 documents, and since some of these are multi-part documents, with each part being handled separately, the actual number of deliverables processed was 306. In addition, 163 Standard Proposals (SP) were processed and there were 143 TSSC reviews. We did see some decrease in meeting attendance due to economic conditions, but overall it was a very busy and productive year.

TIA transitioned Technical Advisory Group (TAG) administration for U.S. TAG ISO TC-100, Audio, Video and Multimedia Systems and Equipment, to the Consumer Electronics Association, and I stepped down as the Technical

## Letter from the Technical Committee Chair

Advisor to that group after six years. TIA again started serving as the Working Advisory Group administrator to Working Group 16, Wide Area Communication, U.S. TAG ISO TC-204, Transport Information and Control Systems.



Time was also spent on training TIA committee leadership on the changes in process as a result of approval and implementation of the new TIA Engineering Manual, which the Technical Committee voted to be effective June 1, 2001.

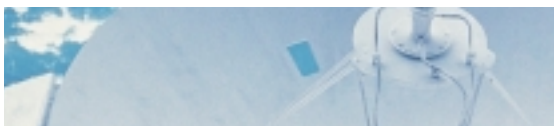
Other important Technical Committee decisions this year included:

- Signing a cooperation agreement with the Inter-American Telecommunication Commission and now treating it as a standards developer under the Technical Committee policy to allow other Standards Development Organizations to use our standards, royalty free; and
- Authorizing the addition of disclaimer language to all new TIA standards to help minimize exposure of TIA in light of a trend in litigation to sue standards developers.

Although I was very familiar with the TIA standards process as a past chair of a formulating group, I found my new task as Technical Committee Chair both challenging and rewarding. I thank all participants and leadership of the TIA standards program for their support this past year, and wish the new Chair well. I particularly want to commend the TIA staff on implementing the TIA Board-mandated reorganization of TIA, as well as planning for even further restructuring. Doing these added tasks along with their "day jobs" took a great deal of dedication.

Sincerely,

James W. Romlein



# TIA Product Division Chairmen

## Fiber Optics

**Vacant**



## Satellite Communications

### Thomas A. Brackey\*\*

Boeing Satellite Systems

*Executive Director, Technical Operations*

TIA sponsors more than 70 standards-formulating groups, including engineering committees and subcommittees, that develop the standards that make high-tech communications possible. These groups are sponsored by five product-oriented divisions — Fiber Optics, Network Equipment,\* Satellite Communications, User Premises Equipment and Wireless Communications.

*\*The TIA Network Equipment Division was inactive in 2001.*

*\*\*Division Advisors to the Board*

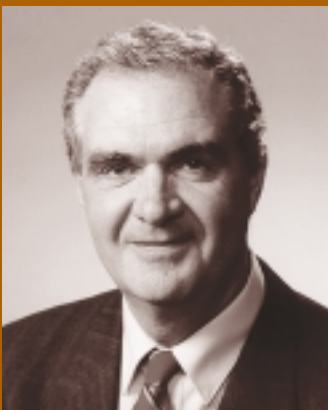


## User Premises Equipment

### Pierre Adornato\*\*

Nortel Networks

*Advisor, Regulatory & Standards*



## Wireless Communications

### Jim Caile\*\*

Motorola, Inc.

*Vice President, Marketing*



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Expanets, Inc.  
Chief Operating Officer





**Mike Kennedy\***

*TIA Vice Chairman  
Motorola, Inc.  
Corporate Vice President & Director,  
Global Government Relations*



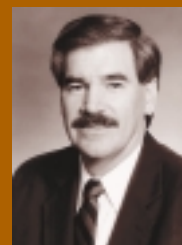
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*Texas Instruments  
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**Greg Farmer**

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**K. Anne Rivers Forcke**

*IBM  
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**Gerry Kennedy**

*Bechtel Telecom  
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**Peter V. Lessek\***

*Lucent Technologies Inc.  
Vice President & General Manager,  
E-Services*



**Gary E. Long**

*Remote Switch Systems, Inc.  
President*



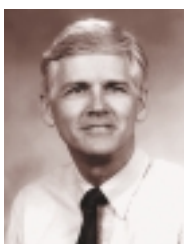
**Sandy Lyons**

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President & CEO*



**Bob Panoff**

*RPM  
Principal*



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*Power & Telephone  
Supply Co.  
President*



**Bill Plummer**

*Nokia, Inc.  
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Government & Industry Affairs*



**Rob Pullen\***

*Tellabs  
Senior Vice President,  
Optical Networking Group*

\*Executive Committee Member

# Emergency Responders Depend on Public Safety Radio Standards to Save Lives and Safeguard Property

**A**dvances in modern communications have been achieved at an exponential pace in the past two decades. And the ways and degrees to which communications technologies are intertwined in everyday lives are truly remarkable.

Modern consumers in many countries take for granted the ease with which everyone can communicate with one another. With the ubiquity of mobile phones and the rise of wireless email it seems that it is now possible to reach almost anyone immediately. More than just a convenience, however, having this ability at one's fingertips can mean the difference between life and death in an emergency. According to the Association of Public-Safety Communications Officials International (APCO), more than 26 percent of 911 calls are now placed from mobile phones<sup>1</sup>; some place that percentage at twice that. We depend on mobile communications and assume the phone will work when we need it without much thought into the behind-the-scenes engineering that makes this possible. In doing so we fail to appreciate what the alternative would be — especially when it concerns the communication among those responsible for ensuring every citizen's safety.

In January 1982, during a snowstorm, Air Florida flight 90 crashed into the 14th Street Bridge, which spans the Potomac River separating Northern Virginia and Washington, D.C. Moments later a Metrorail accident occurred just a few miles away. Responding rescue personnel from federal, state and local public safety agencies quickly discovered that it was difficult to coordinate their efforts because radios from each agency used different frequencies and signaling techniques. Emergency personnel from separate units were forced to swap radios among each other in order to coordinate their crews. The volume of calls in response to the crash, the snowstorm and the subway accident exceeded the capacity of Washington's existing private and public land mobile radio (LMR) communications systems. This inability to communicate was tragic and frightening.

The experience triggered concerted efforts by government, industry and emergency response end users to ensure that the different telecom systems used by the nation's public safety officials are able "speak" to each other. After 1982, it began to be recognized that broad interoperability among all systems was necessary if emergency response is to be maximally effective in saving lives and safeguarding property.

Through ongoing collaborative efforts — and the support of thousands of individuals and dozens of groups — technical standards were created that allow for interoperability and compatibility. But the work is far from completed.

## Communication and Coordination in Times of Emergency

### THE EARLY DAYS OF PUBLIC SAFETY RADIO

Emergency responders typically are organized around dispatchers who receive calls for assistance and relay information to those in the field — for example, police officers, firefighters or emergency medical service (EMS) personnel. When used for such purposes, the system is called "public safety radio." In its early stages the technology of wireless communications was relatively simple, and few were involved in its development. Much of the design and implementation of systems were performed by the users themselves. Radios at the time, like computers in their early incarnations, were cumbersome, and radios that fit into pockets were far from conception.

When emergency response personnel needed to communicate among themselves, they did so face-to-face or they called their dispatcher. The dispatcher in turn would relay those messages face-to-face, in writing or over the telephone. Communication among police, fire and medical officials and different levels of government was limited. Given that wireless systems were rare, it was natural that there existed almost no wireless interagency communications.

Interoperability was not an issue because there was little need for systems to interact. Public safety entities were mostly self-sufficient, and AM was the de facto radio modulation standard. Capabilities such as encryption, digital modulation and multi-channel radios were generally unknown. Use of wireless equipment was limited because it was cumbersome and provided only voice communications, primarily in vehicles. At that time, interagency communications was accomplished through more traditional technologies.

Politics and jurisdictional issues also played a major role in this *status quo* for a long time. As time went on and populations grew, however, the need for interagency communications became more pressing, but the technology and operational framework that would allow this to happen did not exist.

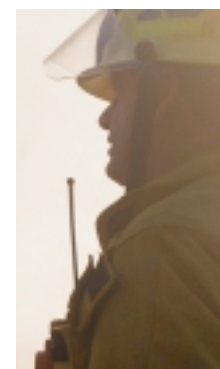
### THE BASICS OF WIRELESS COMMUNICATIONS

In wireless systems, information is transmitted from one radio device over the air at specific frequencies, or channels. Other radios tuned to the same channel pick up the information. Conventional systems of this type assign distinct bands of frequency spectrum to each user group.

Alternatively, trunked radio systems allow multiple talk groups to transmit over a single channel by assigning a specific group to discrete frequencies "on the fly" as needed.<sup>2</sup> Advantages of trunking include faster access to

the system, because it is less likely that all channels will be busy at any given time, and increased channel capacity. This works well under the presumption that individual subscribers use the system only a small percentage of the time, and a large number of users do not use the system at the same time. The same principle has been used for years in the telephone industry, wherein many users share a limited group of telephone trunks allocated and controlled by a telephone switch.

A variety of technologies can serve basic wireless transmission purposes, regardless of the specific frequency to be used. Portable radios, for example, are lightweight, handheld, low-powered wireless communications devices comprising a transmitter and receiver, a microphone and speaker, a battery and an antenna. Mobile radios are larger and designed to be installed inside a vehicle. Because mobile radios connect to the vehicle's battery power supply, they are able to generate higher transmitter output, which increases their transmission range. Mobile units are also able to take advantage of better antennas and antenna planes for additional improvements in performance.



Base- or fixed-station radios are used for primary dispatch and also contain a transmitter and a receiver. They are powered by an external electrical system such as commercial power. A fixed station's antenna can be located up to several hundred feet away or above the radio, typically on top of a building or a tower. By raising the antenna above surrounding terrain the user is often able to improve coverage. Because of their size and power source, fixed-station radios have the most powerful transmitters and sensitive receivers.

Repeaters are used to assist communications between two radios that would otherwise not be able to communicate with each other. The receiver of a repeater is tuned to the incoming signal of one radio and then rebroadcasts that signal on a different frequency matching the receiver of another radio (*e.g.*, base stations or mobile/portable radios).

Limitations exist with these technologies. Before the development of interoperability standards, communications over separate systems could not be achieved because of technology incompatibilities. Furthermore, if each independent agency uses its own set of channels to coordinate its respective officials or teams, communications with

another agency using a different frequency requires a shared channel — such as the public safety “mutual aid” channels. These channels are used to enhance normal capacity and are made available on demand for joint responses; but such a system is less efficient than intra-agency communications.

## Public-Private Sector Cooperation Yields Interoperability

### PROJECT 25 INITIATED TO DEVELOP TECHNICAL STANDARDS

The telecom equipment manufacturing industry and individual members of local, state and federal agencies have engaged in a long-term engineering standards development process known as Project 25. This project was initiated in 1989 by APCO, the National Association of State Telecommunications Directors (NASTD) and various federal agencies — all of which are government users of public safety radio — and by the Telecommunications Industry Association (TIA), representing manufacturers. Project 25 was tasked with specifying digital, narrowband radios with peak performance and which permit maximum interoperability in a competitive market

environment. Participants in TIA's Engineering Committees are the technical experts who are intimately familiar with the technology and user needs.

Working together, participants have successfully developed voice and wireless data standards for digital public safety wireless communications. Project 25 established an unambiguous set of procedures and specifications that were published by TIA as a suite of ANSI/EIA/TIA Standards, TIA/EIA Interim Standards and TIA Telecommunications Systems Bulletins. Although Project 25 originally was an initiative for public safety, and APCO members remain the largest group of LMR users, the resultant documents are also usable in non-emergency land mobile applications. For example, one of America's largest railroads is now testing this technology for use in its nationwide network.

Current standards specify how voice sound waves are converted into digital format and how subscriber units (*e.g.*, mobile and portable radios) and infrastructure components communicate with each other over the air. Together, these Phase I standards represent a major accomplishment of cooperation. With the first phase of the standards process essentially complete, more than 1,800 pages of technical

information have been published. These documents represent a comprehensive response to all the requirements identified by APCO, NASTD and federal users.

Phase II of Project 25 will include standards for both very narrowband Frequency Division Multiple Access (FDMA) and equivalent Time Division Multiple Access (TDMA) technology. The technical specifications will include standard interfaces to consoles, standard interface between repeaters and other subsystems (*e.g.*, trunking system controller). This will allow users to purchase equipment from multiple manufacturers for a single site, rather than being locked into the offerings of any one company. Such standards will greatly enhance centralized training, equipment transitions and the efficient movement of equipment and personnel.

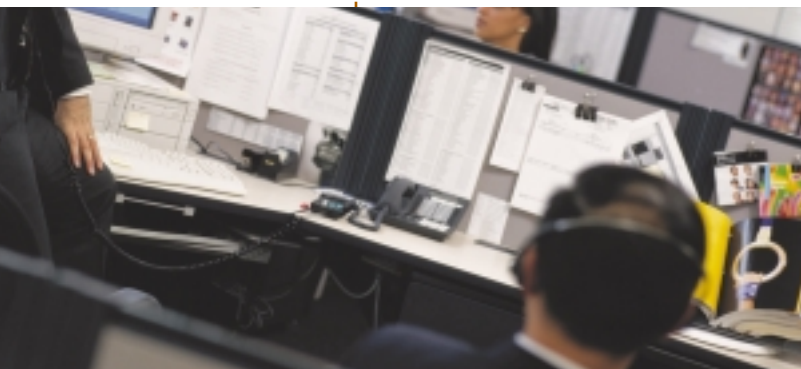
#### THE CONSTRAINTS OF LIMITED SPECTRUM

Along with properly functioning technology, radio communications also requires clear and workable operating

#### THE 800 MHZ BAND

Beginning in early 2000, several public safety agencies operating in the 800 MHz band noticed that their wireless communications were suffering from interference, so much so that their mobile or portable radios could not receive or transmit at all in certain geographic areas. They discovered that the interference was related to the expansion of commercial wireless services — most commonly and intensely from the enhanced specialized mobile radio (eSMR) system operated by wireless carrier Nextel and by other CMRS cellular providers operating in adjacent 800 MHz bands. With the interference becoming increasingly problematic throughout 2001, APCO in November formed a task force to study the problem. The group comprised experts from APCO, the Cellular Telecommunications and Internet Association (CTIA), Nextel, Motorola and the Public Safety Wireless Network (PSWN).

On November 21, 2001, Nextel proposed a plan whereby commercial carriers would move out of the 800



procedures. Having access to enough spectrum is equally important for providing public services. Because spectrum is a finite resource, those wishing to use radiocommunications devices in a given area must cooperate if they are to avoid interference problems. If users operate on the same frequencies, at the same time, and in the same area, their transmissions will create interference in each other's receivers. Each user, in effect, prevents other simultaneous, nearby uses of a portion of the spectrum while transmitting.<sup>3</sup>

The Federal Communications Commission (FCC) is the federal agency tasked with coordinating use of the radio spectrum and assigning users to operate in certain frequency bands. Public safety channels were allocated in several frequency bands, ranging from 40 MHz to near 1.9 GHz. However, the allocations are not contiguous and land mobile radio shared the bands with other users, including commercial mobile radio service (CMRS) providers. In some channels the frequencies were interleaved. Over the years it became clear that public safety radio was reaching its capacity, but there was no vacant adjacent spectrum available.

MHz band where their spectrum interleaved with public safety, thus reducing adjacent channel interference by Nextel and permitting frequency coordination by the public safety sector to minimize this problem.<sup>4</sup> The proposed plan creates larger, contiguous allocations both for Nextel and public safety operations. Several public safety groups supported the plan. Some of Nextel's competitors (*i.e.*, other carriers), however, criticized Nextel's solution as self-serving.<sup>5</sup> They claimed the proposed spectrum reallocation would disrupt provision of their services at their own expense and cost billions of dollars to businesses whose operational communications systems are not causing any interference to public safety operations.<sup>6</sup>

The FCC is under pressure to resolve the issue quickly, as the status quo is unacceptable from the emergency response point of view. However, any reallocation of spectrum will be costly and must prove to be the optimal solution. Clearly, to achieve a workable solution, the federal government, local officials and the commercial users of the spectrum will need to continue to cooperate and engage in open dialogue.

Technology is continually evolving and issues such as interoperability and spectrum shortages will continue to arise repeatedly without farsighted planning.



## Addressing the Need for High-Speed Data Standards

### THE 700 MHz BAND

To mitigate the ever-impending spectrum shortage, the FCC occasionally makes additional channels available for public safety use. In addition to the 800 MHz band, LMR users were allocated parts of the 700 MHz band, which were reassigned from television broadcast services to public safety communications services in 1998. It will be available as soon as existing TV stations vacate the spectrum, which is targeted for no later than December 31, 2006. This new band is intended to satisfy public safety communications needs into the distant future and is intended to provide the capability for a nationwide interoperability system. Standards developed for this wideband channel are to serve as a wireless technology platform for jurisdictions throughout the country to access and receive state-of-the-art functionality. The technology platform will enable better performance of existing networks. At the same time, it will remain compatible with the new technologies being developed for wideband applications requiring transfers of large amounts of data, including streaming Internet Protocol (IP) video and real-time database access.

The Public Safety National Coordination Committee, an advisory committee to the FCC,<sup>7</sup> requested that TIA Engineering Committee TR-8, Mobile and Personal Private Radio Standards, develop interoperability standards for wideband data systems that would use the 700 MHz band.<sup>8</sup> The participants in TR-8 met several times in 2001 in conjunction with Project 25 meetings.<sup>9</sup>

The Project 25 Steering Committee also established an effort, commonly called Project 25/34, to address the need for wideband, high-speed data standards. Project 25/34, in turn, has contributed to the public safety partnership program sponsored by TIA and the European Telecommunications Standards Institute (ETSI) to address data standards in a new cooperative effort known as Project MESA (Mobility for Emergency and Safety Applications).

This effort has worldwide applications and implications. Just as a need developed for cities and states to communicate with their neighboring jurisdictions, formerly distinct regions of the world are finding that they, too, are drawing ever closer. In the near future, with the advent of true broadband capabilities and closer intercontinental cooperation, response to public safety emergencies will be increasingly global in scope.

### PROJECT MESA

The need for greater amounts of data transmission — including voice, pictures, fingerprints, other large data files and full-motion video — will further increase the demand for the limited spectrum available. Furthermore, in addition to the need for agencies to talk across political and jurisdictional boundaries, the next iteration of public safety wireless communications will necessitate increased and



*The original Chair of Committee TR-8, engineering pioneer Dr. Daniel Noble (left), is shown in 1941 with the industry's first commercially available FM mobile transmitter. Pictured with Noble is fellow Motorola engineer Norm Wunderlich.*

*(Above photograph and research courtesy of the Motorola Museum of Electronics.)*

improved system security. Industry has already stepped up to the plate.

TIA and ETSI's Project MESA is focused on even more advanced, mobile broadband technologies. It will produce common specifications that will be transposed, as necessary, into regional standards. Once adopted, the outputs will assist more effective disaster response by officials around the world.

One result will be a harmonized standard for broadband terrestrial mobility applications and services driven by common scenarios and spectrum allocations. The specifications will enable a variety of applications such as the expanded use of wireless and remote robotics that could be used for the containment of chemical spills, the disarmament of bombs or explosives, fire management and control, the identification of hazardous conditions within a fire, locating fire hot spots, pinpointing the locations of victims and firefighters, and many other audio, data, visual and robotic operational functions which are needed in law enforcement, disaster response and civil defense sectors around the world.

### HOW FAR HAVE WE COME?

Although evolving requirements and new challenges will continue to arise, tremendous progress has been made in two decades. The same jurisdictions that created the impetus for cooperation in this sector in 1982 have shown to be a telling case study. By the mid-1990s, the District of Columbia and Northern Virginia had worked together to develop mutual aid plans and procedures. Residents were now being served by interagency operational agreements that defined protocols and allowed emergency crews to operate on each other's LMR systems and thus come to each other's aid.<sup>10</sup> On September 11, 2001, worst-case scenario planning was put to a test. Effective communication



in the Pentagon disaster — when a fuel-loaded jet crashed through one side of the building — has proved the worth of a far-sighted response plan that takes advantage of resources across several localities and agencies.

A total of 50 public safety agencies responded to the incident resulting in approximately 900 radio users attempting communications with various mission requirements and priorities to consider.<sup>11</sup> During the initial response — because the geographic, political and historical circumstances had already pushed Metro Washington area officials to create and put to use a coordinated plan — the majority of local, first responders experienced no difficulty in establishing interoperable communications on the scene. However, as the number of state and federal agencies (secondary responders) increased at the site, interoperability presented new challenges. No means of direct interoperability were immediately available to these secondary response agencies.

Furthermore, major incidents, regardless of location, have shown that commercial service networks are not designed to handle the immense volume of calls generated at or near the scene. This was also the case at the Pentagon on September 11. Emergency rescue crews found that the only reliable form of communications was their own, pri-

vate LMR systems,<sup>12</sup> which did not allow them to communicate with outside parties such as government officials, family members or hospitals.

Today, the United States is experiencing significant growth and population clustering in urban areas, which places greater demands on public safety service providers. They face threats of extreme life and property loss, not only from natural disasters — such as hurricanes, floods, fires and earthquakes — but also from terrorist actions and civil disturbances. These growing threats require rapid response and coordinated information sharing by all public safety agencies — fire and rescue, EMS and law enforcement — at all levels and across borders.

“In emergency situations, telecommunications saves lives,” stated then-International Telecommunication Union Secretary-General Pekka Tarjanne succinctly in 1998, recognizing the critical difference technology makes to humanitarian agencies and disaster response units in times of emergency. When commercial products are not interoperable, the opportunity cost can be expressed in market share and inconvenience. When public safety personnel cannot exchange information and coordinate their response, the risk is to their own lives and the lives of the citizens they protect — that cost is immeasurable. ■

1 According to National Emergency Number Association’s “Report Card to the Nation” (2001): More than 500,000 calls to 911 are made each day, or 190 million a year. Of those, wireless phones account for 50 million. See <http://www.nena9-1-1.org/>.

2 More advanced options that are compatible include encryption of the signal, digitizing the transmission and piggybacking on analog circuits.

3 One of the objectives determined by the Project 25 Steering Committee has been to make public safety users more spectrally efficient. In meeting that objective, the first phase of standards is designed to reduce the channel bandwidth requirements from 25 kHz to 12.5 kHz. The second phase will further reduce channel requirements, to 6.25 kHz.

4 The report by Nextel Communications, “Promoting Public Safety Communications: Realigning the 800 MHz Land Mobile Radio Band to Rectify Commercial Mobile Radio-Public Safety Interference and Allocate Additional Spectrum to Meet Critical Public Safety Needs” (November 21, 2001) and comments to it can be found on the FCC Web site at <http://wireless.fcc.gov/publicsafety/>.

5 For example, in a statement issued on December 4, the United Telecom Council

signaled what it called its “strong opposition” to the Nextel proposal, saying that if the proposal were adopted, it would devastate hundreds of critical infrastructure communications systems now operating in the affected spectrum. The Industrial Telecommunications Association sent a letter to FCC Chairman Powell on December 20 outlining its objections to the Nextel proposal.

6 *Dispatch Monthly* magazine states and illustrates on its Web site: “It was noted that the primary interference is occurring on 70 channels in the 810 to 816 MHz and 854 to 861 MHz bands. Other public safety allocations in the 800 MHz band (821-824 MHz and 866-869 MHz) are not interleaved with commercial allocations and apparently do not suffer from interference problems. Found at <http://www.911dispatch.com/>.

7 The Public Safety National Coordination Committee (NCC) was established by the Federal Communications Commission in 1998 to address and advise the commission on operational and technical parameters for use of the 700 MHz public safety band. It is directed to, among other things, formulate an operational plan to achieve nationwide interoperability, give recommendations regarding federal users’ access to the interoperability spectrum, and recommend relevant standards for FCC review and approval.

8 Wideband channels are defined as 50 kHz wide channels that can be combined with up to 150 kHz. Narrowband channels used in the 800 MHz band, by comparison, comprise 6.25 kHz that can be combined up to 25 kHz.

9 See the report from TIA Engineering Committee TR-8, Mobile and Personal Private Radio Standards, on page 14 of this report for details of public safety standards development activity in 2001.

10 For example, the states of Maryland and Virginia, and the District of Columbia, currently cooperate in the Capital Wireless Integrated Network (CapWIN), an effort to develop a roadmap for wireless standards-based transfer of data for emergency response organizations.

11 PSWN, “Answering the Call: Communications Learned from the Pentagon Attack,” January 2002.

12 Ibid. A copy of this report and other good sources of information on public safety radio standards are available from the PSWN library at <http://www.pswn.gov/library.htm>.

# History of Public Safety Land Mobile Radio

- 1924**..... The Radio Manufacturers Association (RMA) is created by a group of prominent manufacturers to oversee the licensing of a body of intellectual property so that members would have access to all the relevant patents necessary to build radio transmitters, antennas and receivers.
- 1928**..... City of Detroit, Michigan, initiates operation of first one-way amplitude modulation (AM) broadcast radio system for the police department.
- 1935**..... Association of Public-Safety Communications Officials International (APCO) is founded.
- 1940**..... Connecticut State Police begin operating a two-way analog frequency modulation (FM) radio system. The first AM handheld two-way radio was developed for the U.S. Army Signal Corps and was used worldwide during World War II.
- 1944**..... TR-8 meets for the first time as the Committee on Emergency Service, Transmitter Division, of RMA. The three most important technical issues facing the group were system bandwidth, transmitter spurious radiation and ignition noise suppression.
- 1951**..... TR-8 changes its name to Land Mobile Services to reflect expanded scope.
- 1950-57**..... RMA undergoes a series of name changes before becoming the Electronic Industries Association, or EIA (later changed to stand for Electronic Industries Alliance).
- 1960s**..... Solid-state circuits are incorporated into LMR equipment replacing vacuum tubes.
- 1969**..... Manufacturers introduce “tone coded squelch” that makes signaling unique and channel reuse possible. Signaling protocols are shared among various manufacturers.
- 1970s**..... Very Large Scale Integrated (VLSI) circuits are incorporated into LMR equipment and also facilitate further development of microprocessor technologies.
- 1970**..... The first commercial 4-bit microprocessors are introduced and incorporated into LMR equipment.
- 1976**..... Advanced 8-bit microprocessors with five times the execution speed are introduced and used in LMR equipment.
- 1977**..... APCO begins Project 16 with funding from a Law Enforcement Assistance Administration grant.
- 1978**..... The first 16-bit microprocessors are introduced by computer chip manufacturers.
- 1979**..... Project 16 standards are completed. This effort specified features specifically for the public safety industry to be added to existing standards for commercial systems and specialized mobile radio (SMR) systems.
- 1980**..... Commercial 16-bit microprocessors are incorporated into LMR equipment.
- 1982/1983**..... Data Encryption Standard (DES) is introduced. DES further distinguishes system features but does not ensure interoperability and compatibility.
- 1984**..... Thirty-two bit microprocessors and other VLSI chips are incorporated in LMR equipment, providing new and enhanced features and functions.
- Early to mid-1980s**..... LMR manufacturers continue to develop unique, proprietary trunking protocols and produce LMR equipment that is not interchangeable.
- Mid 1980s**..... The Open Architecture Radios for Public Safety (OARPS) committee was formed and attempted to standardize analog trunked radio systems. However, after much research and discussion, it was concluded it was too late to standardize analog trunked systems.
- 1987**..... Additional manufacturers introduce APCO 16-compliant LMR trunk systems.
- 1988**..... The Information and Telecommunications Technology Group of EIA, along with TR-8 and the other Committees it sponsored, was spun off and merged with the United States Telecommunications Suppliers Association to form the Telecommunications Industry Association (TIA).
- 1989**..... APCO Project 25 is initiated to develop commonality between disparate trunking systems technologies as the manufacturers continued to move toward digital technologies.
- 1990s**..... New digital technologies including integrated Dispatch Enhanced Network (iDEN) and Enhanced Digital Access Communication System (EDACS) are developed and incorporated into commercial and public safety systems.
- 1993**..... First voice coder (“vocoder”) Telecommunications Systems Bulletin (TSB) released.
- 1993**..... First transmission of digital trunked 800 MHz radio communication occurred at Florida Highway Patrol, Troop E Headquarters in Miami on March 26, 1993.
- 1994**..... First common air interface TSB released.
- 1994**..... Terrestrial Trunked Radio (TETRA) standards are finalized for trunking systems for LMR system deployments except in North America.
- 1996**..... The Public Safety Wireless Network (PSWN) Program is established as a joint initiative sponsored by the U.S. Department of Justice and the Department of the Treasury in an effort to address public safety radio interoperability.
- 1997**..... Improved Multiband Excitation (IMBE) vocoder selected in an extremely competitive process, based on tests and voice quality measurements. The selected technology was consistent with APCO 25 standards.
- 1998**..... American National Standards Institute (ANSI) approves vocoder and common air interface (CAI) as American National Standards.
- 1999**..... Capital Wireless Integrated Network (CapWIN) project — involving Maryland, Virginia and the District of Columbia — is created to develop the first multi-state transportation and public safety integrated wireless network in the United States.
- 1999**..... The State of Pennsylvania announces its plan to build the first statewide Voice-over-IP wireless network servicing numerous local, state, and federal public safety agencies.
- 2000**..... TIA and ETSI launch the Public Safety Partnership Program (later renamed Project MESA) to accelerate the standards work for third-generation mobile communications.
- 2001**..... The State of Michigan completes the third phase of a multi-year effort to deploy a statewide all-digital trunking system to support various public safety agencies.







*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 systems addressed by these standards include business and industrial dispatch applications, as well as public safety applications such as police, ambulance and fire fighting.*

**T**raditionally, the Committee has provided standards for methods of measurement and performance recommendations for equipment in the private land mobile industry. More recently, however, Committee TR-8's role has expanded to include standards for more sophisticated communications systems. As these systems become more complex, issues of interoperability become increasingly important. Also, issues of coexistence among systems of differing technologies are crucial to the reliability of communications. Particularly in communications systems for public safety and emergency services, reliability and interoperability are of prime importance. Officials of different government agencies are finding the need to communicate more frequently among themselves, and the critical nature of such communications requires avoidance of unwanted interference. As a result, Committee TR-8's work now covers the areas of system compatibility and interoperability.

### 2001 Activities

The past year was one of high activity for Committee TR-8. With the Federal Communications Commission (FCC) opening a new public safety frequency band at 700 MHz, there came an urgent need to develop new

interoperability standards for voice and data applications. In response, the Committee initiated a project to develop standards for wideband data systems. This new spectrum allocation also brought interest in the continuing evolution of existing voice and data standards. The events of September 11 further underscored the importance of developing interoperability standards for communications systems.

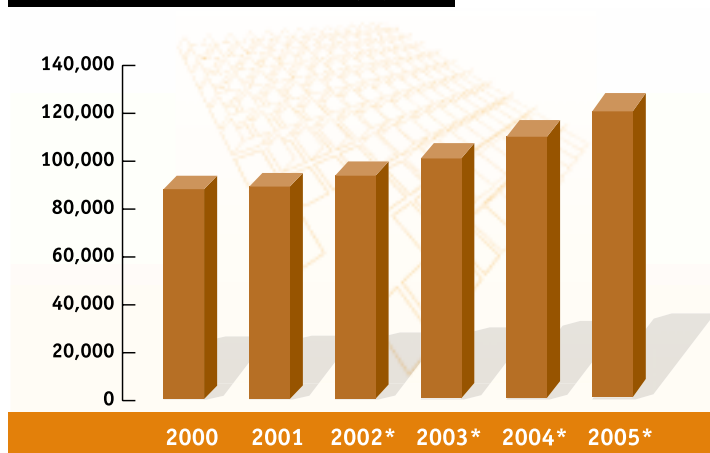
TR-8 and its Subcommittees met five times during 2001. Many of the meetings were held in conjunction with the APCO/NASTD/FED Project 25 meetings. [APCO/NASTD/FED is a collective group of the Association of Public Safety Communications Officials International, Inc. (APCO), the National Association of State Telecommunications Directors (NASTD) and federal government agencies (FED)]. In addition, many of the Subcommittees and the Working Groups met throughout the year, either via teleconference or at various locations.

Within Subcommittee TR-8.18, Wireless Systems Interference and Coverage, work continued on issues of interference prediction and spectrum compatibility. The Subcommittee worked on a revision to Telecommunications Systems Bulletin (TSB)-88, *Wireless Communications Systems — Performance in Noise and Interference Limited Situations — Recommended Methods for Technology-Independent Modeling, Simulation, and Verification*. One of the issues addressed in the document upgrade process was the interference susceptibility between systems using some of the newer digital technologies. An addendum to TSB-88 has been balloted. In addition, the Subcommittee published TIA/EIA-845, *Radio-wave Propagation — Path Loss — Measurement, Validation and Presentation*, to provide a model for interference prediction.

Several TR-8 Subcommittees continued work on Project 25 digital private radio standards documents, a suite of standards which currently consists of 33 published documents. The majority of work during 2001 involved maturing the standards suite by upgrading TSBs and Interim Standards (ISs) to ANSI/TIA/EIA Standards. Four documents were upgraded and published as ANSI/TIA/EIA Standards, including three encryption documents and the transceiver performance recommendations document. In addition, the TR-8 Subcommittees published addenda to three of the documents and had several other documents in ballot as the year drew to a close.

While the Committee did update and publish ANSI/TIA/EIA-603-A, *Land Mobile FM [Frequency Modulation] or PM [Phase*

**U.S. Spending on Voice/Data Equipment** (\$Millions)



Source: 2002 Telecommunications Market Review and Forecast

\*projected



## SUBCOMMITTEES:

**TR-8.3** Encryption  
Chair: Eric Ziolkowski  
Motorola, Inc.

**TR-8.4** Vocoder  
Chair: Jim Holthaus  
E.F. Johnson

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

**TR-8.6** Equipment Performance Recommendations  
Chair: Al Wiecek  
Motorola, Inc.

**TR-8.10** Trunking and Conventional Control  
Chair: Jim Holthaus  
E.F. Johnson

**TR-8.11** Antennas  
Chair: Louis Meyer  
Decibel Products

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

**TR-8.14** Four-Slot TDMA Systems  
Chair: David Taylor  
Marconi

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

**TR-8.17** RF Exposure  
Chair: Nick Buris  
Motorola, Inc.

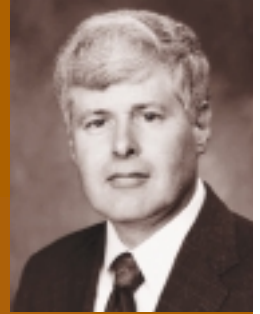
**TR-8.18** Wireless Systems Interference  
and Coverage  
Chair: Bernie Olson  
Motorola, Inc.

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

### John Oblak

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

Vice Chair: Alan Wilson  
Motorola, Inc.



*Modulation*] *Communication Equipment Measurement and Performance Standards*, work continued toward a future update which will incorporate some of the more recent FCC rule changes, particularly those addressing the 700 MHz frequency band. The update is a collaborative effort between Subcommittees TR-8.1, Equipment Measurement Procedures, and TR-8.6, Equipment Performance Recommendations.

In TR-8.17, RF Exposure, work continued on the development of guideline documents for compliance with FCC-mandated Radio Frequency (RF) exposure limits for mobile, portable and base station equipment. The resulting documents will provide guidelines for reporting exposure data, training users in RF safety issues relating to portable equipment, and installing mobile equipment to ensure compliance with mandated emission limits.

Subcommittee TR-8.11, Antennas, worked on revisions to its two existing documents: one for mobile antennas and one for base station antennas. It also published TIA/EIA/IS-804, *Terrestrial Land Mobile Radio — Antenna Systems — Standard Format for Digitized Antenna Patterns*.

With the establishment of the 700 MHz public safety frequency band, standards are required to ensure interoperability between the various public safety entities that will use this band. The National Coordination Committee (NCC), an advisory committee to the FCC, requested that Committee TR-8 develop interoperability standards for wideband data systems. Work began initially in Subcommittee TR-8.5, Signaling and Data Transmission, and resulted in the balloting of three TSBs. TR-8.5 continued to formulate additional documents as well. Work also began in other Subcommittees in terms of developing standards for methods of measure-

ment and performance requirements. The urgent need for such standards caused a great deal of activity during 2001.

Subcommittees TR-8.12, Two-Slot TDMA Systems, and TR-8.14, Four-Slot TDMA Systems, continued their work on formulating standards for their respective Time Division Multiple Access (TDMA) system types. They focused primarily on public safety systems, while developing variants for other applications.

Committee TR-8 also continued to monitor international standards activities through the participation of Committee members and TIA staff. Working Group 8.20, International Activities, focused on some of these issues.

2001 proved to be a year of heightened activity in the development of standards for the private land mobile industry, with the continued maturity of existing documents and the formulation of standards for new systems. Interest in the work of Committee TR-8 remained high, with additional companies joining the standards-making effort and the ongoing participation of various governmental agencies and user groups. The coming year promises to be one of continued effort in the development of standards for critical communications systems. ■



**Craig Snyder**

Chair, TR-14

President  
Sioux Falls Tower  
Specialists

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

**D**uring 2001, only Subcommittee TR-14.7, Structural Standards for Steel Antenna Towers and Antenna Supporting Structures, was active. This Subcommittee sets antenna structure standards used by the American National Standards Institute (ANSI), Electronic Industries Alliance (EIA) and TIA.

### 2001 Activities

Subcommittee TR-14.7 worked towards completing editorial revisions to the updated “bible” for the tower industry: ANSI/TIA/EIA-222, *Structural Standards for Steel Antenna Towers and Antenna Support Structures*. The current standard is its seventh incarnation — version F from 1996. TR-14.7 reaffirmed the current version to preserve the cycle and to allow additional time for completing its successor, and by year-end, the Subcommittee was close to unveiling a major, expanded revision of the standard. The new standard, version G, should be ready to submit to the TR-14 membership and other interested parties for balloting and comment in the spring of 2002, with final adoption forecast for late in the third quarter. The document is expected to make it through the ballot process easily.

All new tower construction, as well as major renovations of existing structures, must conform to ANSI/TIA/EIA-222-G after its adoption. Existing towers will not be affected unless physical alterations are made or antenna loading exceeds the original, approved design. The decision as to which standard applies usually is that of the engineer of record.

Revision G will contain new material and expanded content, and in terms of sheer volume of information, it will surpass its predecessors by three or four times. The depth of the material will require that electronically published versions be made available.

Prepared by eight different task groups, Revision G includes 16 chapters and covers technical issues such as wind and ice loading, seismic loading, design stresses, safety and climbing, and geotechnical requirements. It also includes more than 150 pages devoted solely to state-by-state map graphics illustrating wind, ice, frost and seismic factors.

Revision G will be the most sweeping change in the ANSI/TIA/EIA-222 standard since Revision D was implemented 20 years ago. The Committee’s intent is to create an internationally recognized and acceptable standard,

which can be implemented beyond the North American market. The Committee believes it will eclipse the state of the art in any other standard in the world. The standard, already used by ANSI, TIA and EIA, also is incorporated by reference into the International Building Code. This means that, by default, it becomes the standard of most countries, states and municipalities for their building codes, although there often is a lag of two to three years at the local level to revise requirements and use the new or revised standard.

During 2001, Committee TR-14 also worked on a new gin pole standard, Project Number 4860, *Structural Standards for Gin Poles*. Gin poles are used in tower erection, and this standard will allow tower erectors and designers to merge these technologies and ensure efficiency and safety. ■



## 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 Specialists
- 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

Committee TR-30 develops standards related to the functional, electrical and mechanical characteristics of interfaces between Data Circuit-Terminating Equipment (DCE) and Data Terminal Equipment (DTE), the telephone network, and other DCE and facsimile systems.

### 2001 Activities

The year brought a major change to Committee TR-30 with the absorption of Committee TR-29, Facsimile Systems and Equipment, and its work into TR-30 as a new Subcommittee, TR-30.5, Facsimile Terminal Equipment and Systems.

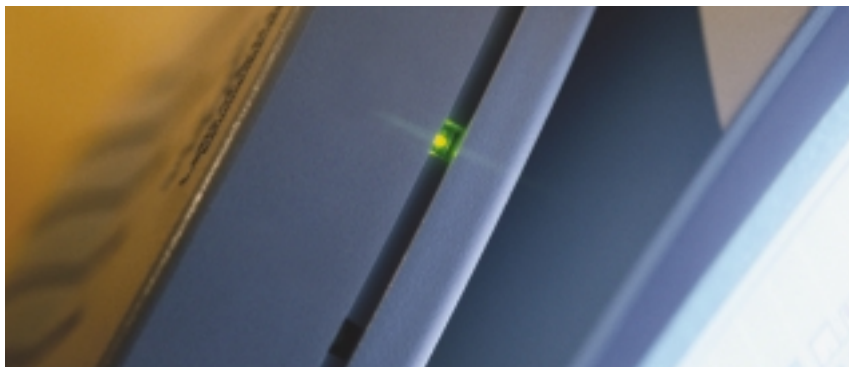
During 2001, TR-30 once again focused much of its attention on contributions to the work taking place in the International Telecommunication Union - Telecommunication Standardization Sector, Study Group 16 (ITU-T SG 16), Multimedia Services, Systems, and Terminals, with particular



**Fred Lucas**

Chair, TR-30  
FAL Associates

- TIA/EIA-404-B, *Start-Stop Signal Quality for Non-Synchronous Data Terminal Equipment*;
- TIA/EIA-423-B, *Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits*;
- TIA/EIA-687, *Medium-Speed Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment*; and



emphasis on contributions to the development of a new ITU-T Recommendation for Modem over IP (V.moip). TR-30 has had a long-standing relationship with the various Rapporteurs in ITU-T SG 16 and continued that association in 2001 as the work on V.moip progressed seamlessly between meetings of Subcommittee TR-30.1 and the Question 11 Rapporteur in ITU-T SG 16.

As Subcommittee TR-30.1, Modems, focused on its close working arrangement with ITU-T SG 16, Question 11, on V.moip, both the Subcommittee and Committee TR-30 developed and approved numerous contributions to the ITU-T process. In addition, TR-30.1 continued to be the major contributor to refining ITU-T Recommendation V.44, *Data Compression Procedures*, and the Recommendation V.9x series, which addresses high-data-rate, two-way digital connectivity.

During 2001, Subcommittee TR-30.2, DTE-DCE Interfaces and Protocols, withdrew TIA/EIA-617, *Data Transmission Systems and Equipment — In-Band DCE Control*, and reaffirmed the following standards:

- TIA/EIA-694, *Electrical Characteristics for an Unbalanced Digital Interface for Data Signaling Rates up to 512 kbit/s*.

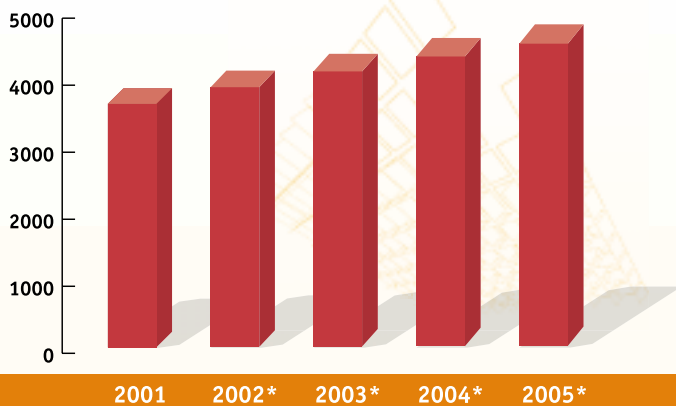
TR-30.2 also completed work on a new electrical characteristic standard, TIA/EIA-899, *Electrical Characteristics of Multipoint Low Voltage Differential Signaling Interface*, which was approved during 2001.

On the international front, Subcommittee TR-30.2 provided contributions to ITU-T SG 16's work on additions and changes to Recommendation V.250, *Serial Asynchronous Automatic Dialing and Control*.

Subcommittee TR-30.3, Data Communications Equipment Evaluation and Network Interfaces, continued to focus on network models in 2001. Project Number 4254, *Network Access Transmission Model for Evaluating xDSL Modem Performance*, is intended to be the basis for performance testing all Digital Subscriber Line (xDSL) systems consisting of central-site modems that interface with a broadband telecommunications network and remote client modems at the customer premises. The model is suitable for evaluating modems that are designed to ITU-T



### Spending on Modem Field Maintenance and Repair



Source: 2002 Telecommunications Market Review and Forecast

\*projected

Recommendations G.992.1, *Asymmetrical Digital Subscriber Line Transceivers*, and G.992.2, *Splitterless Asymmetrical Digital Subscriber Line Transceivers*.

During times of high call volume over wireline and wireless systems, such as during disasters, email messages, carried via modems, have proved a crucial means of communications. TR-30.3 continued its revision of Telecommunications Systems Bulletin (TSB)-38, *Test Procedures for Evaluating Modem Performance*, which involves a major modification of the existing document to align it with today's technologies.

Subcommittee TR-30.5, Facsimile Terminal Equipment and Systems, focused on the ITU-T Internet fax Recommendations T.37, *Procedures for the Transfer of Facsimile Data via Store-and-Forward on the Internet*, and T.38, *Procedures for Real-Time Group 3 Facsimile Communication Between Terminals Using IP [Internet Protocol] Networks*. The primary focus was to add V.34 fax capability to T.38. The

Subcommittee also completed Project Number 3626 (Class 1.0), retrofitting ITU-T Recommendation T.31, *Asynchronous Facsimile DCE Control — Service Class 1*, for incorporation into an updated TIA/EIA-578-B, *Facsimile Digital Interfaces — Asynchronous Facsimile DCE Control Standard, Service Class 1*.

TR-30.5 additionally developed and approved contributions to ITU-T SG 16 regarding modifications to Recommendations T.89, *Application Profile for Recommendation T.88 — Lossy/Lossless Coding of Bi-Level Images (JBIG2) for Facsimile*, and T.30, *Procedures for Document Facsimile Transmission in the General Switched Telephone Network*, for the inclusion of Joint Bi-Level Image Experts Group (JBIG)-2. ■

## SUBCOMMITTEES:

- TR-30.1** Modems  
Chair: Les Brown  
Conexant Systems, 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  
Conexant Systems, Inc.
- TR-30.5** Facsimile Terminal Equipment and  
Systems  
Chair: James Dahmen  
Jim Dahmen Consulting



Wireless consumer communications devices, such as cordless telephones and Citizens Band (CB) radios, are the core products within Committee TR-32's scope. The Committee's work includes maintaining standards, recommending new projects and reviewing work programs for new standards.

### 2001 Activities

No documents or issues required the work of Committee TR-32 during 2001. The Committee remains available to serve in its advisory capacity to TIA, providing technical input on various regulatory matters. Committee members possess many years of technical experience in the cordless telephone and CB radio arenas, giving TR-32 an extensive pool of specific areas of expertise to draw upon as needed.

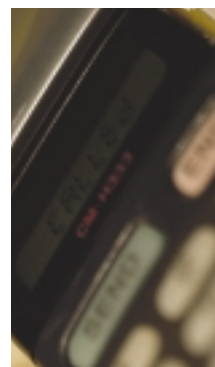
Since cordless telephones are both radio frequency devices and terminal equipment that connects to the



**Roger Bisby**

Chair, TR-32  
Staff Engineer  
Semax Wireless

rules for connection of terminal equipment to the telephone network is reflected in its Report & Order in CC Docket No. 99-216, *2000 Biennial Regulatory Review of Part 68 of the Commission's Rules and Regulations*, known as the "Streamlining Order." This Report & Order turned over responsibility for creation and maintenance of most technical criteria for prevention of harm to the telephone



public switched network, cordless telephones are regulated under both Part 15 and Part 68 of the Federal Communications Commission's (FCC) Rules and Regulations. Thus, cordless telephones are also part of the privatization of Part 68 by the FCC. The Commission's decision on November 9, 2000 to privatize the majority of its Part 68

network to American National Standards Institute (ANSI)-accredited Standards Development Organizations (SDOs).

TIA and the Alliance for Telecommunications Industry Solutions are co-sponsors of the Administrative Council for Terminal Attachment (ACTA), which was tasked by the FCC with adopting the criteria and with administration of the product approval process. The Streamlining Order also included a provision for the use of a Supplier's Declaration of Conformity (SDoC) as a means of achieving equipment approval. The FCC still maintains certain technical criteria and also enforces all of the technical criteria, including those adopted by ACTA after submission by ANSI SDOs. With SDc and Part 68 privatization, cordless telephones now have a faster path to market. ■

### Cordless Phones

| Year | Unit Shipments<br>(SMillions) | Dollar Sales<br>(SMillions) |
|------|-------------------------------|-----------------------------|
| 1997 | 28.2                          | 2,099                       |
| 1998 | 31.3                          | 2,181                       |
| 1999 | 39.7                          | 2,260                       |
| 2000 | 35.1                          | 1,360                       |
| 2001 | 31.7                          | 950                         |

Source: 2002 Telecommunications Market Review and Forecast

*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.*

In addition to developing industry standards specifically for satellite communications equipment, Committee



TR-34 has been working with other Standards Development Organizations (SDOs) to ensure that the standards it produces are acceptable for satellite services. In particular, Subcommittee TR-34.1, Communications and Interoperability, has been working closely with the ATM [Asynchronous Transfer Mode] Forum and the Internet Engineering Task Force (IETF) to ensure the standards developed by these bodies take into consideration the special requirements of satellite communications.

Despite setbacks experienced by the Mobile Satellite Service (MSS) providers during the last two years, the satellite market overall continues to expand, driving the need for collaborative standards development for both interoperability and interconnectivity. For example, in May 2000, the World Radiocommunication Conference (WRC)-2000 was held in Istanbul, Turkey. At this important conference, four separate MSS frequency bands between 1 GHz and 3 GHz were identified for the satellite component of International Mobile Telecommunications (IMT)-2000. These designations included the 2 GHz MSS bands, which previously had not been used commercially for MSS [allocations were made by the International Telecommunication Union (ITU) in 1992 and 1995].

Significant planning and actual manufacturing of spacecraft for use in the 2 GHz MSS bands forged ahead during 2001.

More than four years ago, in September 1997, nine potential new MSS providers initially filed with the Federal Communications Commission (FCC) to offer MSS in the 2 GHz band via geostationary, Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) multi-satellite constellations. In early 1998, the FCC found all nine applications and letters of intent from potential 2 GHz MSS licensees acceptable for filing (Public Notice Report No. SPB-119, March 19, 1998). During summer 2001, the FCC's International Bureau finally granted licenses to eight of the original nine 2 GHz applicants (one withdrew) and established requirements for the licensees to meet strict progress milestones in the construction and launch of their satellites.

ICO, the first of the providers to commit to building an MEO system designed to exploit the new 2 GHz MSS band, successfully launched its first satellite in June 2001 and is now conducting an extensive In-Orbit Test (IOT) sequence to verify its performance. Other systems have filed to offer high-data-rate services via satellite, particularly in the Fixed Satellite Service (FSS) millimeter-wave bands, which will allow Internet access from most parts of the world. These advanced satellite systems, when operational, will provide an option for developing nations that have limited wireline infrastructures, as well as provide an alternative for Internet access — via satellite — that will help ease the traffic on the public switched network. Satellite systems have proven particularly useful when terrestrial wired and wireless systems are taxed due to natural or man-made disasters.

## 2001 Activities

As in recent years, Committee TR-34 primarily concentrated on two major areas — developing standards for satellite communications systems, with a major focus on the Internet, ATM, and Global System for Mobile Communications (GSM) and their seamless operation over satellite transmission paths; and developing interference criteria and interservice frequency-sharing methodologies. This work was accomplished in two Subcommittees — TR-34.1, Communications and Interoperability, and TR-34.2, Spectrum and Orbit Utilization.

Subcommittee TR-34.1 carried out its tasks through Ad Hoc Working Groups that addressed issues related to existing and future standards for the interoperability of the satellite and terrestrial components of communications systems. At the end of 2001, the Ad Hoc Working Groups were as follows:

- Internet Protocols over Satellite
- ATM Speech

## SUBCOMMITTEES:

### TR-34.1 Communications and Interoperability

Chair: Prakash Chitre  
Lockheed Martin Global  
Telecommunications  
Vice Chair: Ferit Yegenoglu  
Lockheed Martin Global  
Telecommunications

### TR-34.2 Spectrum and Orbit Utilization

Chair: Jeffrey Binckes  
ICO-Teledesic Global, Ltd.

- ATM Traffic and Congestion Control
- ATM Multicast over Satellite
- Common Air Interfaces: ATM via Satellite
- Common Air Interfaces: Dual Mode GSM-Compatible GEO [Geostationary Earth Orbit]-Mobile System
- Ka-band Satellite Systems

The output of TR-34.1 generally consisted of TIA Telecommunications Systems Bulletins (TSBs), Interim Standards (ISs) and American National Standards (ANSs). The Working Groups collaborated, when delegated, with appropriate national or international standards bodies.

At the end of 1998, Subcommittee TR-34.1 completed its preliminary work on the Common Air Interface for Satellite Systems, and in 1999 it published TSB-90, *High-Level Requirements for Common Air Interface for GEO-Mobile (Super GEO) Satellite Communications Featuring Interoperation with Terrestrial GSM*, and TSB-91, *Satellite ATM Networks: Architectures and Requirements*. These documents help ensure interoperability among satellite and terrestrial components of such systems by describing high-level requirements for the common air interface specifications for the GEO Mobile Radio (GMR) system. TR-34.1 prepared two families (different system designs) of GMR specifications stemming from this work — GMR-1 and GMR-2 — which were published in 2001.

In addition, the Subcommittee continued its joint standards development activity with the European Telecommunications Standards Institute (ETSI) on a standard for hybrid GEO mobile satellite terminals to ensure commonality with terrestrial equipment. A joint standard collaboration with the ETSI GMR Working Group resulted in a joint-publication agreement. TIA published TIA/EIA/IS-781, *GMR Series 1-5*, and TIA/EIA/IS-782, *GMR-1 Series 1-5*, at the end of 2001. The GMR systems specified in the two standards are GSM-derived and are specified for geostationary satellites and hand-held mobile user terminals that are equipped for dual-mode operation with satellite/terrestrial GSM. The new specifications will accommodate packet data service, provide upgrade capabilities to existing GMR systems data and provide users a transition to an advanced GEO-Mobile Packet Radio Service (GMPRS) system.

Subcommittee TR-34.1 also continued its relationship with the ATM Forum and was active in the Wireless ATM (WATM) Group of the ATM Forum, working to ensure that ATM standards consider satellite requirements.

The Working Group on Internet Protocols over Satellite continued its liaison with the IETF Transmission Control Protocol, Satellite Working Group (TCP-Sat WG), with the goal of ensuring that Internet protocols will not preclude the use of satellites for Internet access. The TCP-Sat WG's remaining work was rolled into the Performance Implications of Link Characteristics (PILC) WG, which developed a draft IETF submission on the risks and impacts of TCP spoofing.

Throughout 2001, the other TR-34.1 Working Groups continued their closely coordinated work with ETSI and the ITU - Telecommunication Standardization Sector (ITU-T), a trend that will be a continuing facet of TR-34.1's standards development efforts.

2001 again brought key FCC actions regarding the 2 GHz band. Subcommittee TR-34.2 and its TIA oversight

## Jeffrey Binckes

Chair, TR-34  
Director, Spectrum  
Engineering North America  
ICO-Teledesic Global, Ltd.



bodies, the Spectrum and Orbit Utilization Section (SOUS) and the Satellite Communications Division (SCD), expressed the association's views to the FCC in two critical proceedings affecting the 2 GHz MSS bands:

- *Notice of Proposed Rulemaking: Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band* (IB Docket No. 01-185, adopted August 9, 2001); and
- *Memorandum, Opinion & Order and Further Notice of Proposed Rulemaking: Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third-Generation Wireless Systems* (ET Docket No. 00-258, adopted August 9, 2001).

Committee TR-34 presented a summary report of its work during the 7th meeting of the Global Standards Collaboration and the 10th meeting of the Radio STandardization (GSC-7/RAST-10) Conference in early November 2001 in Sydney, Australia. ■



*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 criteria for equipment, systems and 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. TR-41 also addresses criteria for preventing harm to the telephone network and the administrative aspects of product approval processes.*

Committee TR-41 has 10 Subcommittees, several of which have one or more Working Groups tasked with responsibility for drafting individual documents.

### 2001 Activities

Committee TR-41 played a major role in implementing the Federal Communications Commission's (FCC) decision to privatize the majority of its Part 68 rules for connection of terminal equipment to the telephone network. On November 9, 2000, the FCC adopted its "Streamlining Order" in CC Docket No. 99-216, *2000 Biennial Regulatory Review of Part 68 of the Commission's Rules and Regulations*. This Report & Order turned over responsibility for creation and maintenance of most technical criteria for prevention of harm to the telephone network to American National Standards Institute (ANSI)-accredited Standards

Development Organizations (SDOs). The Streamlining Order also created the Administrative Council for Terminal Attachments (ACTA). ACTA was charged with adopting criteria, created by the SDOs, for preventing network harms and with administration of the product approval process.

TR-41 continued its leadership in the IP telephony area with the publication of three documents: a new Telecommunications Systems Bulletin (TSB), the revision of a second TSB, and the revision and upgrade of an Interim Standard (IS) to American National Standard (ANS) status. The Committee also made available a spreadsheet tool for modeling the transmission performance of IP telephony connections. At the end of 2001, the Committee had five IP-related projects active, and another dealing with security of IP telephony, in the process of being launched.

Many of Committee TR-41's activities support the theme of this year's STAR: Ensuring Public Safety and Security. The new TR-41.4 project on security considerations for IP telephony is one such example. Projects in TR-41.1 and TR-41.4 dealing with Private Branch Exchange (PBX), Key Telephone System (KTS) and IP terminal support for Enhanced 911 (E911) emergency calling services are others. The technical criteria for prevention of harm to the telephone network developed by TR-41.9 also play an important role in ensuring the ability of the network to meet public safety needs.

TR-41 maintained a close working relationship with Technical Subcommittee T1E1, Interfaces, Power and Protection for Networks, of ANSI-accredited Standards Committee T1, Telecommunications, sponsored by the

## SUBCOMMITTEES:

**TR-41.1** Multiline Terminal Systems  
Chair: Tailey Tung  
Siemens Information and Communications

**TR-41.2** Conformity Assessment  
Inactive

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

**TR-41.4** IP Telephony Gateways and Infrastructure  
Chair: Bob Bell  
Cisco Systems, Inc.

**TR-41.5** Multimedia Building Distribution Systems  
Inactive

**TR-41.6** Wireless User Premises Equipment  
Inactive

**TR-41.7** Environmental and Safety Considerations  
Chair: Randy Ivans  
Underwriters Laboratories  
Vice Chair: Chris Wellborn  
Adtran, Inc.

**TR-41.9** Technical Regulatory Considerations  
Chair: Phillip Havens  
Teccor Electronics  
Vice Chair: Anh Nguyen  
Underwriters Laboratories

**TR-41.10** Private Integrated Services Networks  
Chair: Mo Zonoun  
Nortel Networks

**TR-41.11** Administrative Regulatory Considerations  
Chair: Greg Slingerland  
Mitel Corporation  
Vice Chair: John Shinn  
Sanmina Corporation



Alliance for Telecommunications Industry Solutions (ATIS). TR-41 also maintained liaison with Industry Canada's Terminal Attachment Program Advisory Committee (TAPAC), the European Telecommunications Standards Institute's Speech Transmission Quality Technical Committee (ETSI STQ) and the Telecommunication Certification Body (TCB) Council.

There were leadership changes in several TR-41 Subcommittees as a result of elections; however, overall leadership did not change as Steve Whitesell of VTech was re-elected chair.

Subcommittee TR-41.1, Multiline Terminal Systems, deals with systems primarily intended for business applications. Work completed included: TSB-116, *Voice Quality Recommendations for IP Telephony*, adoption of International Organization for Standardization/International Electrotechnical Commission (ISO/IEC) document ISO/IEC 11573:1994, *Synchronization Methods and Technical Requirements for Private Integrated Services Networks*, as TIA/EIA-594-A. Work on the revision of TIA/EIA-464-B, *Requirements for Private Branch Exchange Switching Equipment*, neared completion, with the document expected to be balloted in early 2002. TR-41.1 also worked on updating TIA/EIA-689, *PBX and KTS Support of Enhanced 911 Emergency Service Calling*, to include formats and protocols for Automatic Location Identification (ALI) data exchange.

Subcommittee TR-41.2, Conformity Assessment, kept TIA members and participants updated on the status of various Mutual Recognition Agreements and Arrangements (MRAs). It also kept members informed on the rollout of the European Union's Radio and Telecommunications Terminal Equipment (R&TTE) Directive and the FCC's efforts to streamline its rules and privatize product approvals in the United States. Supplier's Declaration of Conformity (SDoC) was supported by TR-41.2 as a model for future global product conformity assessment and now is in effect. As a result, the Subcommittee decided to go into inactive status following its May meeting.

Subcommittee TR-41.3, Analog and Digital Wireline Terminals, had two Working Groups actively involved in drafting IP telephony-related standards and three more involved in more traditional telephony issues. TR-41.3.1 expects to submit a revised CallerID document for industry ballot and publish it with a modified title as TIA/EIA-777-A, *Caller Identity and Visual Message Waiting Indicator Equipment Performance Requirements*, by the middle of 2002. Working Group TR-41.3.2, Stutter Dial Tone, was dissolved after the document it was working on was published in June as TIA/EIA-855, *Stutter Dial Tone Detection Device Performance Requirements*.

The TR-41.3.3 Working Group, VoIP [Voice-over-IP] and PCM [Pulse Code Modulation] Transmission Performance, resumed work on Project Number 3-4705, *Transmission Requirements for Wideband Digital Wireline Telephones*. The Working Group suggested the International Telecommunication Union - Telecommunication



## Stephen R. Whitesell

**Chair, TR-41**

Senior Technical  
Consultant — Standards  
VTech Advanced American  
Telephones

**Vice Chair:** Roger Britt  
Nortel Networks



Standardization Sector's (ITU-T) Study Group 12 consider the requirements in TIA/EIA-810-A, *Transmission Requirements for Narrowband Voice over IP and Voice over PCM Digital Wireline Telephones*, for revising its Recommendations dealing with similar subjects.

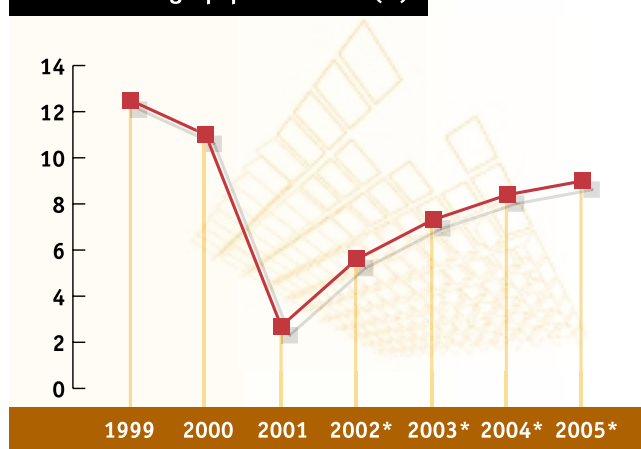
Working Group TR-41.3.5, Analog Terminals, split the revision of TIA/EIA-470-B, *Performance and Compatibility Requirements for Telephone Sets with Loop Signaling*, into a series of related projects including cordless telephone range measurement procedures, electroacoustics, resistance and impedance, and alerting.

Subcommittee TR-41.4, IP Telephony Gateways and Infrastructure, published TSB-122-A, *Voice Router/Gateway Loss and Level Plan Guidelines*, as the revision of a document published in 2000. In a follow-on to this work, TR-41.4 developed and began the process of balloting a complete standard for the voice transmission performance of routers and gateways, including loss and level plans and other aspects of voice transmission, such as frequency response and noise. The Subcommittee also completed development of a new standard under Project Number 3-4726, *Location Identification and Callback Procedures for IP Terminals*, to support E911 service. This document will be balloted soon and should be published by mid-year. However, TR-41.4 terminated a project to study the impact of the International Emergency Preference Scheme (IEPS) on IP telephony due to a lack of contributions.

In an effort to better align project assignments with the interests of the Committee's membership, Working Group TR-41.3.4, VoIP Terminals, was transferred to Subcommittee TR-41.4 and renumbered TR-41.4.4. Work to revise TIA/EIA-IS-811, *Performance and Interoperability Requirements for VoIP Feature Telephones*, resumed.

Subcommittee TR-41.5, Multimedia Building Distribution Systems, published TIA/EIA-854, *A Full*

## Growth of Data Communications and Internetworking Equipment Market (%)



Source: 2002  
Telecommunications  
Market Review and  
Forecast  
\*projected

*Duplex Ethernet Physical Layer Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling.* Having completed this work, the Subcommittee decided to go into inactive status.

Subcommittee TR-41.7, Environmental and Safety Considerations, had two Working Groups involved with safety issues and a third dealing with Radio Frequency (RF) immunity requirements. Working Group TR-41.7.1, Harmonization of International Safety Standards, maintained a close liaison with UL on product safety standards. It also provided TIA input to the U.S. Technical Advisory Group (TAG) for the IEC product safety standard, IEC 60950, *Safety of Information Technology Equipment*. It additionally provided input to the U.S./Canadian Bi-National Working Group (BNWG), which recommends North American adaptations of IEC 60950 that become UL product safety standards. Working Group TR-41.7.2, Commercial Building Grounding and Bonding, has completed all work on its revision of TIA/EIA-607, *Commercial Building Grounding and Bonding Requirements for Telecommunications*. The document will be published as a joint TIA/T1 standard, J-STD-037, and TR-41.7.2 will be dissolved. The EMC Considerations Working Group, TR-41.7.3, continued its revision of TIA/EIA-631, *Radio Frequency Immunity Requirements for Equipment Having an Acoustic Output*, published in 1996. The FCC has reported that the number of complaints received about telephones being susceptible to RF interference has decreased substantially since its publication.

Subcommittee TR-41.9, Technical Regulatory Considerations, established a new TR-41.9.1 Working Group, and charged it with producing the first industry version of the FCC Part 68 rules. As required by the FCC's Streamlining Order, TIA/EIA/IS-968, *Technical Requirements for Connection of Terminal Equipment to the Telephone Network*, was technically identical to the criteria that previously had been in Part 68. The FCC waiver processes for Asymmetrical Digital Subscriber Line (ADSL) modems and stutter dial tone detection devices were codified in a second document, TIA/EIA/IS-883, *Supplemental Technical Requirements for Connection of Stutter Dial Tone Detection Devices and ADSL Modems to the Telephone Network*. The documents were

published in June and immediately submitted to ACTA for adoption as the criteria with which equipment must comply in order to be connected to the telephone network. TR-41.9.1 was subsequently charged with a new project: to revise and upgrade TIA/EIA/IS-968 to ANS status. The supplemental stutter dial tone detector and ADSL modem criteria from TIA/EIA/IS-883 will be folded into the document in the process. Harm-related requirements for 56K V.90 modems, as well as other changes to the document for which there is widespread industry support, also will be included in the revision.

TR-41.9 held joint working sessions with T1E1.4 Working Group, Digital Subscriber Line Access, to identify harm-related criteria appropriate for other technologies providing broadband access. This cooperative effort produced the first T1E1-sponsored document identifying criteria for prevention of harm to the network: T1.TR.Q.6-2001, *Technical Requirements for SHDSL, HDSL2, HDSL4 Digital Subscriber Line Terminal Equipment to Prevent Harm to the Telephone Network*, which was approved and submitted to ACTA for adoption.

Subcommittee TR-41.10, Private Integrated Services Networks, develops private Integrated Services Digital Network (ISDN) standards. It also makes recommendations on private ISDN networks for use in U.S. TAG positions submitted to the ISO/IEC Joint Technical Committee-1 (JTC-1). TR-41.10 continued work on four projects to adopt ISO/IEC publications as American National Standards, but with extensions to allow full interworking with the North American public ISDN. It also initiated a new project to develop a mapping between the Q reference point signaling protocol (Qsig) used in private ISDN networks and the Session Initiation Protocol (SIP) used in some IP networks.

Subcommittee TR-41.11, Administrative Regulatory Considerations, played a major role in helping industry make a smooth transition from FCC Part 68 processes to those now required for ACTA. The FCC turned over to ACTA responsibility for the numbering and labeling of approved equipment. TR-41.11 already had been working on these issues and was able to quickly develop TIA/EIA/TSB-168, *Labeling Requirements*. The document describes a much simplified numbering and product labeling scheme that is applicable to both the TCB and SDoC processes for product approval. It was submitted to and adopted by ACTA. TR-41.11 also saw the need for developing a set of guidelines for companies wishing to use the new SDoC process for equipment approval. The document was approved and published as TIA/EIA/TSB-129, *Guide to the U.S. Supplier's Declaration of Conformity Process*. The document was also submitted to ACTA for its consideration. Work began to revise this document to include information pertinent to the TCB approval process. All of the relevant information from the informal *FCC Part 68 Application Guide* that was previously maintained by TR-41.11 will be included. When finalized, TSB-129-A will be a complete guide to product approval for telephone terminal equipment. ■

*Committee TR-42 develops voluntary standards for telecommunications cabling infrastructure, specifically those used for, but not limited to, voice, video and data networking. The Committee's standards work covers telecommunications cabling within a commercial building and between buildings in a campus environment and specifies component requirements, field-test and installation requirements, cabling distances, telecommunications outlet/connector configurations and recommended topologies.*

**T**R-42's work addresses the design and construction of telecommunications facilities for commercial buildings, including customer-owned outside plant. Telecommunications facilities generally are the pathways into which telecommunications media are 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 work also extends to telecommunications cabling installed within single-family or multi-occupant residences, and applies to mobile homes, marine construction and other buildings to the extent practicable. TR-42 additionally formulates positions and proposals for harmonization with other 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, such as BICSI.

Committee TR-42 is organized into nine Subcommittees and two Working Groups, each responsible for a specific area of telecommunications cabling for commercial, industrial and residential buildings.

### 2001 Activities

Committee TR-42's efforts covered a broad range of activities during 2001, including publication of TIA/EIA-568-B, *Commercial Building Telecommunications Cabling Standard*, through a series of three documents: TIA/EIA-568-B.1, which specifies general requirements for telecommunications cabling in commercial buildings; TIA/EIA-568-B.2, which specifies detailed requirements for copper cabling; and TIA/EIA-568-B.3 (published in 2000), which specifies detailed requirements for optical fiber cabling.

The TIA/EIA-568-B series of standards continues to recognize both twisted pair copper and optical fiber media and provides guidelines on cable selection and distance limits. Optical fiber principally is used for backbone cabling between buildings on a campus or between networking equipment on different floors of a building. Twisted-pair copper is primarily used for horizontal distribution between networking equipment in a telecommunications

room and work area equipment, such as a personal computer, data terminal or telephone.

Subcommittee TR-42.7, Telecommunications Copper Cabling Systems, completed the technical work leading to the publication of a complete set of transmission requirements for Category 5e cabling for the channel and all the components, including cables, cords and connecting hardware. These requirements are incorporated in the TIA/EIA-568-B.2 standard for components and TIA/EIA-



### Paul Kish

**Chair, TR-42**  
Director, IBDN Systems  
and Standards  
NORDX/CDT Corp

**Vice Chair:** Robert Jensen  
Fluke Networks

568-B.1 for channel and link performance, as measured in the field after installation. Category 5e is the base performance level for all new data cabling installations. Category 5 is no longer recognized in the TIA/EIA-568-B.1 standard for the second outlet (intended for data).

Subcommittee TR-42.7 also neared completion of the technical work leading to publication of a Category 6 standard. This standard eventually will be published as an addendum to TIA/EIA-568-B.2. The project, which began in 1997, is the principal activity of TR-42.7 and its associated cable and connector Working Groups. Category 6 is a cabling system that is specified up to 250 MHz, while Category 5/5e is specified only to 100 MHz. Category 6 provides twice the available bandwidth when compared with Category 5/5e. Most of the technical challenges relate to developing test procedures and requirements for patch cords and connecting hardware that will ensure backwards compatibility with existing Category 5/5e installations, as well as interoperability between different vendors' Category 6 products.

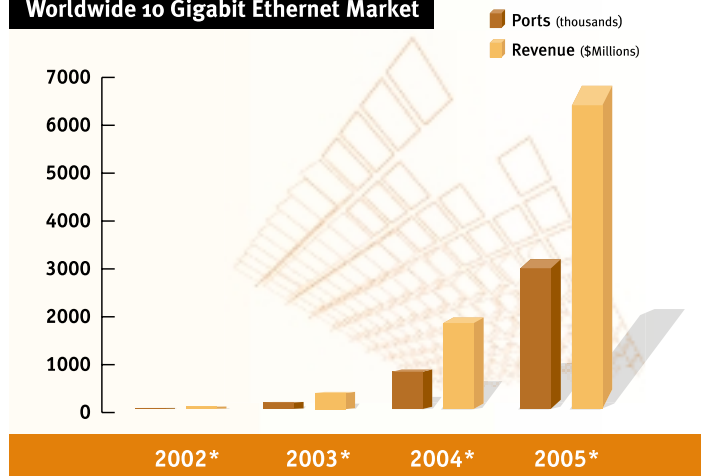
Draft 10 of the proposed Category 6 standard was out for ballot at the end of December 2001. Depending on whether there are any technical changes, the Category 6 standard could be approved as early as March 2002, but more likely in June 2002.

Subcommittee TR-42.8, Telecommunications Optical Fiber Cabling Systems, worked on developing a standard for a next-generation multimode fiber that could support 10 Gb/s data transmission rates for distances of up to 300 meters using serial data transmission and cost-effective Vertical Cavity Surface Emitting Lasers (VCSELs). This work was closely coordinated with IEEE 802.3, which is





## Worldwide 10 Gigabit Ethernet Market



Source: 2002  
Telecommunications  
Market Review and  
Forecast  
\*projected

looking at different 10 Gb/s Ethernet technologies and is on a fast track to publish a 10 Gb/s Local Area Network/Wide Area Network (LAN/WAN) networking standard by 2002 for both multimode and single-mode fiber. The next-generation multimode fiber standard eventually will be published as an addendum to TIA/EIA-568-B.3.

Subcommittee TR-42.3, Commercial Building Telecommunications Pathways and Spaces, completed the technical work leading to the publication of three new addenda to TIA/EIA-569-A, *Commercial Building Standards for Telecommunications Pathways and Spaces*. These addenda specify the requirements for underfloor systems, design requirements for multi-tenant buildings and cable pathway fill. The addendum for multi-tenant buildings is a major addition to the standard to fulfill a need in the industry. TR 42.8 also started work on the next revision of the TIA/EIA-569, Revision B.

Subcommittee TR-42.2, Residential Telecommunications Infrastructure, worked on several new addenda to TIA/EIA-570-A, *Residential Telecommunications Cabling*

*Standard*. This new technical work grows in importance as more persons take advantage of the benefits of home networking, including interconnection of computers, peripheral devices, entertainment systems, security systems and control systems. The current residential cabling standard covers voice, video and data applications. The new addenda will complete the missing pieces for a total home networking solution and will enhance and extend the utility of the current standard in the marketplace.

TR-42 continued to grow in scope and diversity with a global perspective. At both the Subcommittee and Working Group levels, there was an ongoing technical exchange and dialogue with international experts in the field of cable, connector, and system performance and testing, with the intent of ensuring that the TIA cabling standards are a technically compatible subset of and fully harmonized with international standards.

The Committee also worked on the development of several new standards:

- a new cabling standard for industrial buildings;
- a new standard for network distribution nodes (data centers); and
- an extension of the commercial building cabling standard to include building automation systems. It is anticipated that this standard, to be published as TIA/EIA-862, will be approved sometime in 2002.

The gigabit era has introduced many new challenges, not only for copper, but also for fiber. The world is in a period of change, and the latest documentation from TR-42, its Subcommittees and Working Groups continued to evolve to meet the increased bandwidth demands of future applications. For the end user, it is important to keep abreast of these changes in technology to ensure making the right cabling infrastructure decisions. ■

## SUBCOMMITTEES:

|                |  |                |  |
|----------------|--|----------------|--|
| <b>TR-42.1</b> | Commercial Building Telecommunications Cabling<br>Chair: John Siemon<br>The Siemon Company<br>Vice-Chair: Herb Congdon<br>Tyco Electronics | <b>TR-42.5</b> | Telecommunications Infrastructure Terms and Symbols<br>Chair: Ray Keden<br>Erico, Inc.         |
| <b>TR-42.2</b> | Residential Telecommunications Infrastructure<br>Chair: Bob Jensen<br>Fluke Networks   | <b>TR-42.6</b> | Telecommunications Infrastructure Administration<br>Chair: Mel Lesperance<br>Ortronics, Inc.   |
| <b>TR-42.3</b> | Commercial Building Telecommunications Pathways and Spaces<br>Chair: Bob Jensen<br>Fluke Networks  | <b>TR-42.7</b> | Telecommunications Copper Cabling Systems<br>Chair: Masood Shariff<br>Consultant (Avaya)       |
| <b>TR-42.4</b> | Customer-Owned Outside Plant Telecommunications Infrastructure<br>Chair: Donna Ballast<br>University of Texas/BICSI                        | <b>TR-42.8</b> | Telecommunications Optical Fiber Cabling Systems<br>Chair: Herb Congdon<br>Tyco Electronics    |
|                |  | <b>TR-42.9</b> | Industrial Telecommunications Infrastructure<br>Chair: William Sewell<br>Holmes & Narver, Inc. |



*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, and internetwork and intersystem operations and interfaces.*

**C**ommittee TR-45 is composed of six Subcommittees and several Ad Hoc Groups that focus on particular aspects of mobile and personal communications systems specifications and standards.

## 2001 Activities

During 2001, Committee TR-45 and its Subcommittees submitted for TIA publication or revision nearly 100 standards or multipart documents and Telecommunications Systems Bulletins (TSBs).

Subcommittee TR-45.1, Analog Technology, completed work resulting in four TIA publications: TIA/EIA/IS-817, *A Position Determination Standard for Analog Systems*; TSB-16-A, *Assignment of Access Overload Classes in the Cellular Telecommunications Services*; TIA/EIA/TSB-121, *Cellular Subscriber Unit Interface for TDD*; and TIA/EIA/IS-798, *Mechanical Mounting of Phone System Envelope and Mounting Requirements*. A potential new project under consideration is a revision of TSB-70-A, *FSK [Frequency Shift Keying] Air Interface Common Message Protocol Cross-Reference*, to include changes associated with geolocation messaging for analog across technologies.

The work of Subcommittee TR-45.2, Wireless Intersystem Technology, led to TIA publication of several standards including TIA/EIA/IS-847, *Roamer Database Verification*; TIA/EIA/IS-875, *Enhanced International Dialing, Calling Number Identification and Callback, Calling Party Category Identification*; TIA/EIA-93-B, *Wireless Telecommunications: Ai-Di Interface*; and TIA/EIA/IS-771-1, *Wireless Intelligent Network — Addendum 1*. Numerous parts of TIA/EIA-41-E, *Wireless Radio Telecommunications Intersystem Operations*, were issued for ballot, with an anticipated publication-ready date in the first quarter of 2002.

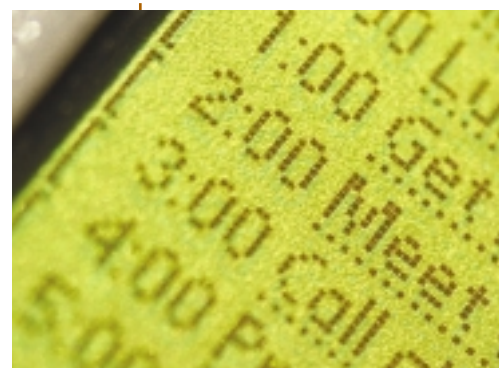
TR-45.2 worked with the Alliance for Telecommunications Industry Solutions (ATIS) Technical Subcommittees T1P1, Wireless/Mobile Services and Systems, and T1S1, Services, Architectures and Signaling, to address Lawfully Authorized Electronic Surveillance (LAES) and Emergency Services. The joint activities resulted in the publication of TIA/EIA/IS-J-STD-036-1, *Enhanced Wireless 911 Phase 2 — Addendum 1*, and advancement of the work for LAES.

These standards are of particular importance to the industry, government and consumers in ensuring public safety and security.

In the spirit of global partnerships, TR-45.2 continued to work closely with the Third Generation Partnership Project 2 (3GPP2) Technical Specification Group on Core Networks (TSG-N) to develop specifications for standardization as it relates to the cdma2000 technology and IP Core Network.

Subcommittee TR-45.3, Time Division Digital Technology, completed its work on Revision C of TIA/EIA-136, the TDMA third-generation wireless standard. Several parts of the TIA/EIA-136 series were published, including:

- TIA/EIA-136-310-A-1, *TDMA Third Generation Wireless — Radio Link Protocol — 1 — Addendum 1*;



- TIA/EIA-136-350-A-1, *TDMA Third Generation Wireless — Data Service Control — Addendum 1*;
- TIA/EIA-136-440-1, *TDMA Third Generation Wireless — Adaptive Multi-Rate (AMR) Codec — Addendum 1*;
- TIA/EIA-136-033-1, *TDMA Third Generation Wireless — R-UIM [Removable-User Identity Module] File Structure — Addendum 1*;
- TIA/EIA-136-410-1, *TDMA Cellular PCS [Personal Communications Services] — Radio Interface — Enhanced Full-Rate Voice Codec — Addendum 1*; and

## Cheryl J. Blum

**Chair, TR-45**  
Technical Manager  
Lucent Technologies Inc.

**Vice Chair:** Gerry Flynn  
Verizon Wireless



Source: 2002  
Telecommunications  
Market Review  
and Forecast  
\*projected

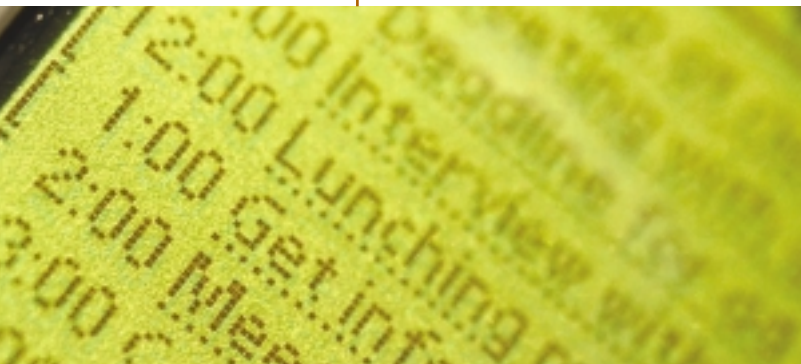
| Cellular Handset Sales |                                 |                            |  |
|------------------------|---------------------------------|----------------------------|--|
| Year                   | Number of Handsets (\$Millions) | Average Price (\$Millions) | Cellular Handset Spending (\$Millions) |
| 1997                   | 17.6                            | 187                        | 3,291                                  |
| 1998                   | 20.9                            | 166                        | 3,469                                  |
| 1999                   | 26.8                            | 143                        | 3,832                                  |
| 2000                   | 20.3                            | 108                        | 3,272                                  |
| 2001                   | 33.4                            | 90                         | 3,006                                  |
| 2002*                  | 36.7                            | 70                         | 2,569                                  |

■ TSB-132, *TDMA Cellular PCS — Radio Interface — Elementary File Alignment Issues in TIA/EIA-136-033.*

At the sixth meeting of the International Telecommunication Union - Radiocommunication Sector (ITU-R) Working Party 8F, held in Tokyo, Japan, in October 2001, all steps were completed for inclusion of the complete

Subcommittee TR-45.4, Radio to Switching Technology, approved two standards for TIA publication in 2000 that ultimately were published in 2001, namely, TIA/EIA-829, *Tandem Free Operation (TFO)*, and TIA/EIA/IS-2001-A, *Interoperability Specifications (IOS) for cdma2000 Access Network Interfaces*. Publication of TIA/EIA-828-A, *BTS-BSC [Base Transceiver Station-Base Station Controller] Inter-Operability (Abis Interface)*, and TIA/EIA-895, *CDMA Tandem Free Operation*, was anticipated by year-end 2001. In the ongoing spirit of the globalization of standards development, TR-45.4 continued its relationship with 3GPP2 relative to the impact of Internet Protocol (IP) in the Radio Access Network (RAN) and other related aspects of standardization.

Meanwhile, Subcommittee TR-45.5, Spread Spectrum Digital Technology, continued to be highly prolific in the publication of third-generation cdma2000 standards,



Revision C package in the next revision of ITU-R Recommendation M.1457, *Detailed Specifications of the Radio Interfaces of IMT [International Mobile Telecommunications]-2000*.

Regarding another international initiative, representatives from TR-45.3 and TR-45.5, Spread Spectrum Digital Technology, actively participated in and completed parts of the European Telecommunications Standards Institute (ETSI)-developed European Harmonised Standards for UMTS [Universal Mobile Telecommunications System]/IMT-2000.

In the areas of location determination and Teletypewriter/Telecommunications Device for the Deaf (TTY/TDD) standards development, Subcommittee TR-45.3 published TIA/EIA/IS-869, *TDMA Third Generation Wireless — Analog SAMPs [System-Assisted Mobile Positioning Satellite] Support in TIA/EIA-136-C; TIA/EIA/IS-840-A, Minimum Performance Standards for Text Telephone Signal Detector and Text Telephone Signal Regenerator*; and TIA/EIA/IS-823-A, *TTY/TDD Extension to TIA/EIA-136-410 Enhanced Full Rate Speech Codec*. In addition, several parts of TIA/EIA-136 for Revision D were submitted for ballot with an anticipated publication-ready date in January 2002.

including the TIA/EIA/IS-2000.X-2 series of standards, such as:

- TIA/EIA/IS-2000.1-2, *Introduction for cdma2000 Standard for Spread Spectrum Systems — Addendum 2*;
- TIA/EIA/IS-2000.2-2, *Physical Layer Standard for cdma2000 Spread Spectrum Systems — Addendum 2*;
- TIA/EIA/IS-2000.3-2, *Medium Access Control (MAC) Standard for cdma2000 Spread Spectrum Systems — Addendum 2*;
- TIA/EIA/IS-2000.4-2, *Signaling Link Access Control (LAC) Standard for cdma2000 Spread Spectrum Systems — Addendum 2*;
- TIA/EIA/IS-2000.5-2, *Upper Layer (Layer 3) Standard for cdma2000 Spread Spectrum Systems — Addendum 2*; and
- TIA/EIA/IS-2000.6-2, *Analog Signaling Standard for cdma2000 Spread Spectrum Systems — Addendum 2*.

It is important to note that these standards were developed in conjunction with 3GPP2. Moreover, TR-45.5 submitted for inclusion in the next revision of the ITU-R Recommendation M.1457 the standards related to the cdma2000 IMT-2000 radio interface.

TR-45.5 submitted for TIA publication more than a dozen additional standards, including, but not limited to,

## SUBCOMMITTEES:

- TR-45.1** Analog Technology  
Chair: John Kay  
Motorola, Inc.
- TR-45.2** Wireless Intersystem Technology  
Chair: Terry Watts  
SBC Technology Resources, Inc.
- TR-45.3** Time Division Digital Technology  
Chair: Peter Nurse  
Lucent Technologies Inc.
- TR-45.4** Radio to Switching Technology  
Chair: Stephen Jones  
NEC America, Inc.
- TR-45.5** Spread Spectrum Digital Technology  
Chair: Jean Alphonse  
Lucent Technologies Inc.
- TR-45.6** Adjunct Wireless Packet Data Technology  
Chair: Ed Campbell  
CommWorks Corporation, a 3Com Company

standards for position determination, packet data services, R-UIM, minimum performance base station and mobile station standards, and speech services. Among these standards were:

- TIA/EIA/IS-801-1, *Position Determination Service Standards for Dual Mode Spread Spectrum Systems — Addendum 1*;
- TIA/EIA/IS-707-A-2, *Data Service Options for Spread Spectrum Systems - Addendum 2*;
- TIA/EIA/IS-890, *Test Application Specification (TAS) for High-Rate Packet Data Air Interface*;
- TIA/EIA/IS-820-1, *Removable User Identity Module for Spread Spectrum Systems — Addendum 1*;
- TIA/EIA-97-D, *Recommended Minimum Performance Standards for Base Stations Supporting Dual Mode Spread Spectrum Systems*;
- TIA/EIA-98-D, *Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Mobile Stations*; and
- TIA/EIA/IS-733-2, *High-Rate Speech Service Option 17 for Wideband Spread Spectrum Communications Systems — Addendum 2*.

Highlights of the activities of Subcommittee TR-45.6, Adjunct Wireless Packet Data Technology, include the TIA publication of the much-anticipated TIA/EIA/IS-835-A, *cdma2000 Wireless IP Network Standard*, and TIA/EIA-732, *Cellular Digital Packet Data (CDPD) System Specification*. It is important to note that the CDPD standard comprises more than 40 separate documents. With meetings collocated with the 3GPP2 Technical Specification Group on Packet Data (TSG-P), TR-45.6 continued to work on wireless IP network standards and wireless IP architecture based on Internet Engineering Task Force (IETF) protocols.

With the increased concern about public safety and security, the work of the TR-45 Ad Hoc Authentication Group (AHAG) proved of particular interest to the wireless industry. A key AHAG activity was its joint meetings with 3GPP2 Technical Specification Group on Service and System Aspects (TSG-S) to discuss the scope and charter of the newly formed Working Group 4 (WG4). In general, WG4 is to assume responsibility for all cdma2000 security architecture and protocol work, while the AHAG continues to address cryptographic algorithm development and analysis. The AHAG work plans for Enhanced Cryptographic Algorithms (ECA) during 2001 included Revisions A through C, with Revision C targeted for completion before the end of 2001.

Also, TSB-100-A, the TR-45 Wireless Network Reference Model, was published based on the work and recommendation of the TR-45 Network Reference Model Ad Hoc Group.

With the anticipated exhaust of the 32-bit Equipment Serial Number (ESN) manufacturer codes targeted for the third quarter of 2004, the TR-45 User Identity Module/Equipment Serial Number Ad Hoc Group (UIM/ESN AHG) worked diligently to address the related standards and industry concerns. Furthermore, the Subcommittees and AHGs worked to investigate any potential impacts of using ESN codes for UIM-ID assignment. With the anticipated retirement of the current ESN Administrator, TIA staff agreed to fulfill the role beginning in 2002.

TR-45 established a new Ad Hoc Group on LAES at the TR-45 level. Terri Brooks of Nokia and Gary Pellegrino of CRAG, Inc., were appointed chair and vice chair, respectively. To address the broader range of systems and technologies associated with packet mode communications surveillance, TR-45 began soliciting input from other industry and standards fora.

Overall, TR-45 continued to play an important role in the development of international standards. ■



*Committee TR-46 develops and maintains performance, compatibility, interoperability and service standards for the Personal Communications Services (PCS) band, now commonly referred to as the 1900 MHz band.*

The Committee generates documents that cover systems engineering for the service descriptions, network architectures, and functional and physical aspects of personal communications for U.S. telecommunications networks. These are applicable to both wireless and wireline access and to the networking between systems. The Committee also develops positions and technical contributions on related subjects under consideration in other domestic and international standards forums, including the International Telecommunication Union - Telecommu-

## SUBCOMMITTEES:

**TR-46.1** Wireless Multimedia and Messaging Services (WIMS)  
Chair: Kourosh Parsa  
Golden Bridge Technology, Inc.

**TR-46.2** Network Interfaces  
Chair: Mike Williams  
VoiceStream Wireless

**TR-46.3** Network Interoperability (NIT)  
Chair: Ronald Ryan  
Nortel Networks



nication Standardization Sector (ITU-T) and Radiocommunication Sector (ITU-R) Study Groups.

TR-46 additionally maintains a close liaison with other TIA standards forums, particularly Committee TR-41, User Premises Telecommunications Requirements, and Committee TR-45, Mobile and Personal Communications Systems, as well as with external standards organizations, including the Alliance for Telecommunications Industry Solutions (ATIS) Committee T1, Technical Subcommittee T1P1, Wireless/Mobile Services and Systems; the Institute of Electrical and Electronics Engineers (IEEE); and the European Telecommunications Standards Institute (ETSI).

### 2001 Activities

Committee TR-46 continued to contribute to TIA standards activities on both the national and international levels, with direct participation in international standards activities, continued enhancement and development of the PCS interference project, and a close relationship with T1P1 in the enhancement and development of network interoperability technology.

The year brought the disbanding of Subcommittee TR-46.1, Wireless Multimedia and Messaging Services, as the work of the Subcommittee was completed.

The major activity of Subcommittee TR-46.2, Network Interfaces, was Project Number (PN) 4868, the development of an American National Standard (ANS) describing interference between the currently deployed PCS second-generation (2G) systems, and the second-and-a-half-generation (2.5G) systems and third-generation (3G) systems.

The Subcommittee previously developed Telecommunications Systems Bulletin (TSB)-84-A, *Licensed PCS-to-PCS Interference (PN-4000)*, which describes interference between the various standardized licensed band PCS systems. Because the Subcommittee believes U.S. PCS band operators likely will deploy some of the proposed 2.5G and 3G technologies in the licensed PCS band, the current project revises and improves the previously published TSB-84-A to include 2G, 2.5G and 3G systems, with the objective of having it adopted as an ANS so operators can assess the interference potential from the mixture of such systems.

Several of these proposed new systems have been modified recently to change significant Radio Frequency



(RF) characteristics, and this resulted in new contributions to TR-46.2 concerning incorporation of the proposed system changes into the Subcommittee's work. Also, several technical contributions from other Standards Development Organizations and regulatory bodies were forwarded to TR-46.2 for review and possible incorporation into PN-4868. The Subcommittee additionally discussed and studied several related potential interference issues, including High Altitude Platform Stations (HAPS) and Ultra-Wideband Technologies (UWB).

TR-46.2 believes the allocation of U.S. 3G spectrum is imminent and that it will be able to incorporate the new frequency allocation information into its project. The new document will be ready to enter the Verification and Validation process in the second quarter of 2002.

Subcommittee TR-46.3, Network Interoperability, continued its heavy meeting calendar to progress work

| PCS Handset Sales |                                 |                    |  |
|-------------------|---------------------------------|--------------------|--|
| Year              | Number of Handsets (\$Millions) | Average Price (\$) | Cellular Handset Spending (\$Millions) |
| 1997              | 3.9                             | 292                | 1,139                                  |
| 1998              | 2.5                             | 251                | 635                                    |
| 1999              | 7.5                             | 221                | 1,658                                  |
| 2000              | 13.7                            | 2000               | 2,732                                  |
| 2001              | 20.4                            | 180                | 3,663                                  |
| 2002*             | 25.9                            | 160                | 4,139                                  |

Source: 2002  
Telecommunications  
Market Review  
and Forecast  
\*projected

on the joint T1-TIA standard on interworking between ANSI-41 and Global System for Mobile Communications (GSM)-based networks. The interworking solution was completed and is captured in J-STD-038 Revision A, *Network Interworking Between PCS 1900/GSM and ANSI-41*, as a three-volume set covering Architecture, Stage 1 Service Descriptions, Stage 2 Information Flows, and Stage 3 Message Mappings. The Revision A enhancements include the interworking issues associated with General Packet Radio Service (GPRS).

The next revision of J-STD-038 will include the technical issues associated with GSM and IS-2000 networks. While it will require close cooperation and work with Subcommittee TR-45.5, Spread Spectrum Digital Technology, no major issues are anticipated. ■



## Chris Wallace

Chair, TR-46  
Vice President,  
Technical Standards  
Nokia Inc.

*Committee FO-2 develops physical-layer system and active component test procedures, as well as system design guides, to assist both suppliers and users of fiber optic communications technology. Interoperability and multivendor compatibility are important concerns for the Committee, as is interfacing with international standards organizations.*

Committee FO-2 consists of five Subcommittees, one Working Group and one Correspondence Group. These address the performance and reliability of active components and systems. Components include transmitters, receivers, amplifiers and modulators. Systems include single-mode digital and analog systems, optically amplified systems with Dense Wavelength Division Multiplexing

FO-2 continued to maintain liaisons with several domestic organizations. ATIS Technical Subcommittee Working Group T1X1.5 has a mandate covering architectural and operational issues of optically amplified systems and DWDM systems and therefore interfaced with FO-2.7, which is concerned with physical-layer aspects of the same subjects. Also, the Institute of Electrical and Electronics Engineers (IEEE) interfaced with FO-2.2, Digital Multimode Systems, on Ethernet applications.

On the international front, FO-2 generated, reviewed and submitted documents to the International Electrotechnical Commission (IEC) Technical Committee 86 on Fibre Optics, Subcommittee 86C, Fibre Optic Systems and Active Devices, specifically its Working Group 1, Fibre Optic Systems and Subsystems, and its Working Group 3,



(DWDM), point-to-point multimode systems and Local Area Network (LAN) applications. The Committee maintains close cooperation with FO-6, Committee on Fiber Optics, concerning fiber, cable and passive components.

### 2001 Activities

The Committee FO-2 plenary meetings are held jointly with FO-6 and usually with Working Group T1X1.5, Optical Hierarchical Interfaces, of Committee T1 Technical Subcommittee T1X1, Digital Hierarchy and Synchronization, sponsored by the Alliance for Telecommunications Industry Solutions (ATIS). In 2001, the FO-2 Subcommittees and its Working Group met January 8-11, in Palm Springs, California, and June 25-28 in South Portland, Maine. The first meeting of 2002 is scheduled for January 21-24 at Koloa on Kauai Island, Hawaii. For the first time, new rules for the election of chairs will be implemented.

Organizationally, Working Group FO-2.1.1, Optically Amplified Devices, Subsystems and Systems, became Subcommittee FO-2.7, keeping the same name. Formerly it had the unusual position of being both a Working Group and a Formulating Group simultaneously. The change takes care of this anomaly.

Optically Amplified Systems. FO-2 also worked with International Telecommunication Union - Telecommunication Standardization Sector (ITU-T) Working Party 4/15 on Optical Transport Network (OTN) technology.

FO-2 continued the conversion of Optical Fiber System Test Procedures (OFSTPs) into Fiber Optic Test Procedures (FOTPs), as agreed to in 2000. Also, the Committee made the adoption process of IEC documents as TIA American National Standards Institute (ANSI) documents smoother.

Subcommittee FO-2.1, Single-Mode Systems, reviewed a number of IEC drafts that were in the voting progress, along with several potential submissions to the ITU-T October meeting. Particularly important new topics that may be submitted to these bodies address future high-speed 40 Gb/s systems. They are Return-to-Zero (RZ) waveforms, which have very different properties from the current Non-Return-to-Zero (NRZ) types, and Polarization Mode Dispersion (PMD) emulators used primarily to test the PMD compensators that will be needed.

The Subcommittee decided OFSTP-8 and OFSTP-9 on fast Bit-Error Rate (BER) measurements, by sinusoidal and threshold methods respectively, would be combined and

## SUBCOMMITTEES:

- FO-2.1**    Single-Mode Systems  
Chair: Allen Cherin  
Lucent Technologies Inc.
- FO-2.2**    Digital Multimode Systems  
Chair: Gair Brown  
U.S. Navy
- FO-2.3**    Opto-Electronic Sources,  
Detectors and Devices  
Chair: Robert Gallenberger  
Spawar Systems Center
- FO-2.6**    Reliability of Fiber Optic Systems  
and Active Optical Components  
Chair: Pin Su  
Chorum Technologies
- FO-2.7**    Optically Amplified Devices,  
Subsystems and Systems  
Chair: James Matthews  
Corning Incorporated

tracked in the IEC as 61280-2-8. This is important because the BER of systems is required to be lower for data transmission than for voice traffic. The Subcommittee made some progress on OFSTP-5 on data analysis of BER.

Subcommittee FO-2.2, Digital Multimode Systems, reviewed the High Performance Parallel Interface (HIPPI) 6400 Mb/s Optical Specification, IEC 60825-1 on eye safety; and the work of IEEE 802.3, 10 Gigabit Ethernet (10GbE). Telecommunications Systems Bulletin (TSB)-62.20, *Enhanced Bandwidth Performance over Laser-Based, Multimode Fiber Local Area Networks*, was published in February, and TIA/EIA-785, *100 Mb/s Physical Layer Medium Dependent Sublayer and 10 Mb/s and 100 Mb/s Auto-Negotiation on 850 nm Fiber Optics*, was published in May.

Working Group FO-2.2.1, Modal Dependence of Multimode Fiber Bandwidth, addressed 10 Gb/s transmission over high-bandwidth multimode fiber in both modeling and experiment. This drove the specifications and test methods for the optical source (by encircled flux) and for fiber bandwidth [by Differential Mode Delay (DMD)] for 10GbE.

Subcommittee FO-2.3, Opto-Electronic Sources, Detectors and Devices, discussed drafts of measurement of digital receiver eye width and advanced draft FOTP-142, *Modal Noise Power Penalty for Laser Transmitters*. FOTP-203, *Launched Power Distribution Measurement Procedure for Graded-Index Multimode Fiber Transmitters*, was published in June.

Subcommittee FO-2.6, Reliability of Fiber Optic Systems and Active Optical Components, discussed comparisons of laser reliability as presented in Telcordia/Bellcore GR-468, IEC 61751, and MIL-STD-883. The Subcommittee identified problems with the IEC document, and a TIA document on this topic may be created.

FO-2.6 also addressed the increasingly important problem of how to handle modules that are made up of

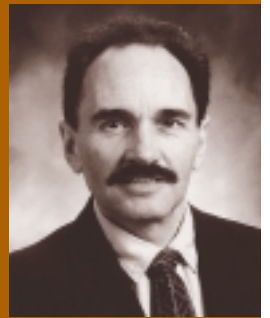
many passive and/or active components. These are expensive, and, practically, only a few are allowed to be tested. Yet, some degree of reliability needs to be assured. Similar discussions occurred in the IEC as well. Finally, FOTP-130, *Elevated Temperature Life Test for Laser Diodes*, was published in March.

Subcommittee FO-2.7, Optically Amplified Devices, Subsystems and Systems, usually meets in conjunction with T1X1.5 and reviewed a large number of potential U.S. contributions to systems Questions in the ITU, including Q.16/15 on terrestrial transport networks. The contributions addressed the optical supervisory channel, very short-range intra-office applications (up to 2 kilometers and 40 Gb/s, with possibly a photonic cross-connect in the path), and Coarse Wavelength Division Multiplexing

### Felix P. Kapron

Chair, FO-2

Manager, Standards  
Engineering  
Corning Incorporated



(CWDM) using cheaper uncooled lasers for distances of tens of kilometers.

For ITU Q.17/15 on optical amplifiers and passive optical components, the Subcommittee discussed G.671, *Transmission Characteristics of Optical Components and Subsystems*, especially document restructuring, parameters specification by application, PMD vs. Differential Group Delay (DGD), and the addition of a Dynamic Channel Equalizer (DCE). Three wavelength division multiplexing classes were proposed: DWDM, CWDM and Wide Wavelength Division Multiplexing (WWDM). ■

*Committee FO-6 develops Fiber Optic Test Procedures (FOTPs), Informative Test Methods (ITMs), Fiber Optic Connector Intermateability Standards (FOCISs) and specifications for components of fiber optic systems. These components include fiber, cable, inter-connecting devices, passive optical components, sensors, and field tooling and instrumentation. The Committee also addresses quality assessment, reliability and product performance.*

**F**O-6 has five Subcommittees and 18 Working Groups to meet the needs of users, suppliers and other standards organizations throughout North America and the world. The Committee meets formally twice a year and maintains more than 200 published American National Standards related to the testing and specification of fiber optic components.

### 2001 Activities

Committee FO-6 continued to meet jointly with Committee FO-2, Committee on Optical Communications Systems, providing additional opportunity to develop synergy between systems and components standardization efforts. In addition, the Alliance for Telecommunications Industry Solutions (ATIS) Technical Subcommittee T1X1, Digital Hierarchy and Synchronization, began collocating its meetings with the FO Committees, bringing network operators' perspectives to the standards development activity as well.

FO-6 met in January and June during 2001. Participants of all Subcommittees and Working Groups attended the meetings, as did the International Electrotechnical Commission (IEC) Technical Advisory Groups (TAGs) to IEC Technical Committee (TC) 86, Fibre Optics.

FO-6 has electronic reflectors and File Transfer Protocol sites available for the Committee, Subcommittees and Working Groups and has a goal of going all-electronic by June 2003.

Committee FO-6 took an active interest in the ongoing activities of both domestic and international standards organizations and continued to maintain and establish formal liaisons with organizations having mutual interests. In

North America, these included ATIS Committee T1, the ATM [Asynchronous Transfer Mode] Forum, the Optical Internetworking Forum (OIF), the Institute of Electrical and Electronics Engineers (IEEE) and the Insulated Cable Engineers Association (ICEA).

Internationally, FO-6 developed several technical contributions in support of work in the International Telecommunication Union - Telecommunication Standardization Sector (ITU-T). FO-6 also participated in the 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; and
  - ISO/IEC Joint Technical Committee 1/SC25 on Interconnection of Information Technology Equipment.
- Subcommittee FO-6.1, Fiber Optic Test, Measurement and Inspection Instrumentation, approved a new scope for standardization of fiber optic test, measurement and inspection instrumentation, and related calibration issues. Initial work will focus on the development of several Telecommunications Systems Bulletins on various fundamental fiber optic instrumentation and measurement issues.
- Subcommittee FO-6.1 initiated several new projects on which to develop white papers:
- fiber optic power meters,
  - optical return loss meters,
  - multifiber connector reference cables,
  - polarization dependent loss meters,
  - high-bandwidth Optical-to-Electrical (O/E) converters,
  - optical network analyzers,
  - fiber optic test sources,
  - optical spectrum analyzers, and
  - Polarization Mode Dispersion (PMD) meters.

On the calibration side, Subcommittee FO-6.1 continued its close liaison with the IEC Calibration Group, IEC TC 86 Working Group 4, and will adopt the IEC calibration documents once available. The current list of documents being monitored includes:

- the calibration standard for fiber optic power meters, IEC 61315;
- the calibration standard for chromatic dispersion, IEC 61744;
- the calibration standard for glass geometry, IEC 61745; and
- the calibration standard for Optical Time Domain Reflectometers (OTDRs), IEC 61746.

Also, FO-6.1 agreed to withdraw the 573000 series for field portable tools due to a lack of demand.



**Steven E. Swanson**

Chair, FO-6  
Manager, Standards Engineering  
Corning Incorporated



## SUBCOMMITTEES:

- FO-6.1** Fiber Optic Test, Measurement and Inspection Instrumentation  
Chair: Dennis Horwitz  
RIFOCS Corp.
- FO-6.3** Interconnecting Devices and Passive Components  
Chair: Thomas Ball  
Lucent Technologies Inc.
- FO-6.6** Optical Fibers  
Chair: Gregory Smith  
Corning Incorporated
- FO-6.7** Fiber Optic Cable  
Co-Chair: Eric Loytty  
Corning Cable Systems  
Co-Chair: Michael Kinard  
Lucent Technologies Inc.
- FO-6.9** Polarization-Maintaining Fibers, Connectors and Components  
Chair: Rex Craig  
National Institute of Standards and Technology

Subcommittee FO-6.3, Interconnecting Devices and Passive Components, made significant progress in the areas of connector end-face geometry measurements and passive component metrology, including:

- a new FOTP for single fiber ferrule connector end-face geometry,
- a new FOTP for multifiber ferrule connector end-face geometry,
- a new document on end-face quality assessment addressing automated evaluation of scratches, pits and other visual defects,
- round-robin testing aimed at assessing industry capabilities for measuring end-face geometry,
- a new FOTP on relative group delay on chromatic dispersion of passive components, and
- a new FOTP on high-power characterization of passive components.

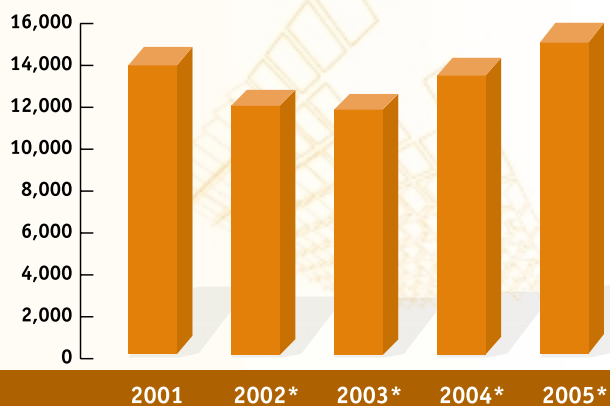
Work also continued on the standardization of fiber optic connector interface standards.

Reliability of passive components remained a key consideration for FO-6.3. Working Groups looked at adhesive reliability, failure mode analysis for connectors and the relationship between end-face quality and reliability during service life.

The Subcommittee chose Rob Johnson from Corning Incorporated as the new chair of the FO-6.3.5 Working Group, Passive Fiber Optic Devices. It also established a task force to address harmonization issues between TIA and the IEC.

Subcommittee FO-6.6, Optical Fibers, continued to maintain an extensive portfolio of published standards,

### Fiber Spending by Carriers



Source: 2002  
Telecommunications  
Market Review and  
Forecast  
\*projected

managed several round robin tests, and developed new procedures where needed. It led in adopting IEC standards.

Other work included the completion of a new FOTP measuring Differential Mode Delay (DMD) and a new Specification for 850nm laser-optimized fiber in support of IEEE's 10-Gigabit Ethernet project. Also, authorization was given on new methods for measuring PMD, nonlinear coefficients and Raman gain.

FO-6.6 monitored several international groups and noted progress on the completion of spectral bands, a new document on Coarse Wavelength Division Multiplexing (CWDM), and the measurement of PMD compensators. Several round robin measurements under way include:

- effective area,
- Raman gain,
- fiber curl, and
- nonlinear coefficient.

Subcommittee FO-6.7, Fiber Optic Cable, completed several tasks during the year including the work on ribbon cables and on hydrogen effects on cable, as well as effectively all of the work on cable specifications.

Subcommittee FO-6.7 agreed to adopt ICEA cable specifications where appropriate, and a Memorandum of Understanding between TIA and ICEA on fiber cable specifications is expected during first quarter 2002. It will allow the joint development of cable specifications, while a license agreement will allow TIA to adopt ICEA cable specifications.

Subcommittee FO-6.7 continued to monitor the activities on L-band performance in the ITU and plans to back-adopt a shotgun damage test from IEC.

Subcommittee FO-6.9, Polarization-Maintaining Fibers, Connectors and Components, began processing several standards concerning Polarization-Maintaining (PM) connector measurements related to insertion loss and return loss, polarization crosstalk measurement and specifications of PM connectorized assemblies. ■

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Main Phone: +1.703.907.7700  
Facsimile: +1.703.907.7727  
[www.tiaonline.org](http://www.tiaonline.org)



## TIA Standards and Technology Department

**Seated:** Thanos Kipreos, Carolyn Bowens, Dan Bart, Bari St. Cyr, Stephanie Montgomery

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### Phone

(703) 907-7701

(703) 907-7703

(703) 907-7551

(703) 907-7961

(703) 907-7726

(703) 907-7974

(703) 907-7704

(703) 907-7491

(202) 383-1480

(703) 907-7735

(703) 907-7556

(703) 907-7555

(202) 383-1480

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(202) 383-1480

(202) 383-1480

(703) 907-7722

(703) 907-7474

(703) 907-7719

(703) 907-7744

(703) 907-7413

(703) 907-7709

(703) 907-7713

(703) 907-7732

(703) 907-7716

### Email

[mflanigan@tia.eia.org](mailto:mflanigan@tia.eia.org)

[dbart@tia.eia.org](mailto:dbart@tia.eia.org)

[janderson@tia.eia.org](mailto:janderson@tia.eia.org)

[randerson@tia.eia.org](mailto:randerson@tia.eia.org)

[cbowens@tia.eia.org](mailto:cbowens@tia.eia.org)

[rcoulter@tia.eia.org](mailto:rcoulter@tia.eia.org)

[shoyler@tia.eia.org](mailto:shoyler@tia.eia.org)

[ribar@tia.eia.org](mailto:ribar@tia.eia.org)

[tkipreos@tia.eia.org](mailto:tkipreos@tia.eia.org)

[smontgomery@tia.eia.org](mailto:smontgomery@tia.eia.org)

[fotieno@tia.eia.org](mailto:fotieno@tia.eia.org)

[bstcyr@tia.eia.org](mailto:bstcyr@tia.eia.org)

[dthompson@tia.eia.org](mailto:dthompson@tia.eia.org)

[bzidecko@tia.eia.org](mailto:bzidecko@tia.eia.org)

[gseiffert@tia.eia.org](mailto:gseiffert@tia.eia.org)

[bbelt@tia.eia.org](mailto:bbelt@tia.eia.org)

[rbreden@tia.eia.org](mailto:rbreden@tia.eia.org)

[jderr@tia.eia.org](mailto:jderr@tia.eia.org)

[dkhlopin@tia.eia.org](mailto:dkhlopin@tia.eia.org)

[grosenblatt@tia.eia.org](mailto:grosenblatt@tia.eia.org)

[mbradshaw@tia.eia.org](mailto:mbradshaw@tia.eia.org)

[enelson@tia.eia.org](mailto:enelson@tia.eia.org)

[jchalden@tia.eia.org](mailto:jchalden@tia.eia.org)

[andy@tiab2b.com](mailto:andy@tiab2b.com)

[hwieland@tia.eia.org](mailto:hwieland@tia.eia.org)

[mlesso@tia.eia.org](mailto:mlesso@tia.eia.org)

[aamselle@tia.eia.org](mailto:aamselle@tia.eia.org)

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\*Only the Standards & Technology and Technical Regulatory Affairs staff are listed in their entirety.

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**Telecommunications Industry  
Association**

2500 Wilson Blvd.  
Suite 300  
Arlington, VA 22201-3834 USA  
phone +1.703.907.7700  
fax +1.703.907.7727  
[www.tiaonline.org](http://www.tiaonline.org)



**External Affairs and  
Global Policy Office**

1300 Pennsylvania Ave., N.W.  
Suite 350  
Washington, DC 20004-3002 USA  
phone +1.202.383.1480  
fax +1.202.383.1495

**TIA West**

514 Bryant Street  
Suite 112  
Palo Alto, CA 94301-1733 USA  
phone +1.650.473.9496  
fax +1.650.473.9299

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