



*F. A. Andrews, Jr.*

# FREDERICK T. ANDREWS

1926–2013

Elected in 1988

*“For contributions and leadership in the establishment of world telecommunication standards and in the development of digital transmission and switching systems.”*

BY STEVE WEINSTEIN

SUBMITTED BY THE NAE HOME SECRETARY

The IEEE Communications Society (ComSoc), together with the larger IEEE community, was saddened by the death on September 15, 2013, of a deeply respected and admired colleague, FREDERICK THOMAS ANDREWS.

Fred was president of ComSoc in 1986–1987, among many other responsible positions he held in both ComSoc and the IEEE. He was elected an IEEE fellow in 1973 for “contributions to digital transmission and to systems, and to transmission objectives and standards” and eventually became an IEEE life fellow. He was a noted communications industry innovator and executive, retiring as vice president for Technology Systems of Bellcore, the telephone companies’ R&D organization that came out of the breakup of AT&T. It later became Telcordia and, most recently, a unit of Ericsson. To the many people he worked with in ComSoc and the telecommunications industry he was also a modest and good-natured colleague and friend, a model for the idea that a great manager can at the same time be a gentle and considerate human being.

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Fred—better known to his family by his middle name “Tom”—was born October 6, 1926, and graduated in electrical engineering from Pennsylvania State University in 1948. A brilliant student, he was chair of the university’s IEEE Student Branch in 1946–1947 and valedictorian of his engineering class, and after graduation was quickly hired by Bell Laboratories, where he worked for the next 35 years on digitization of the telephone network. He made pioneering contributions to digital communications, most significantly to development of the first commercial PCM (pulse-code modulation) system, a huge innovation after many decades of reliance on FDM (frequency division multiplexed) systems for transmission of multiple voice channels either between local telephone offices or over large inter-city distances. The ambitious plan was to use existing twisted pairs, interconnecting telephone offices, that had previously been used for one voice channel alone, for a multi-channel TDM (time division multiplexed) signal. The 24-channel T1 system that resulted was one of the most important telecommunications innovations of the 20th century.

Fred and the other young engineers defining a digital transmission system came up with concepts that were critically important to a successful design, addressing problems such as baseline wander (for the decision threshold between “1s” and “0s”) and crosstalk between twisted pairs. As he reported in his April 2011 article “Early T-carrier history” in *IEEE Communications Magazine*, “One day the proverbial light bulb went on and we had the idea that solved this [baseline wander] and several other problems. If ‘1s’ were transmitted by alternative positive and negative pulses and a ‘0’ by no pulse, there would be virtually no wander.... Bob Aaron analyzed the new bipolar proposal [and] was quick to show that the new bipolar line signal’s frequency components extended to only half the frequency of the original line signal. The resulting lower crosstalk levels saved the day.” Fred contributed to further innovations in this first T-carrier system including the frame synchronization scheme. As Irwin Dorros notes, these contributions “[made] it possible to get 1.544 megabits per second on wire pairs that had inherent distortions and crosstalk, at

one mile repeater spacings. It doesn't sound like much now, but it was a great achievement at the time in the 1960s." True to Fred's character, his 2011 article is full of acknowledgments to colleagues while claiming little for himself, but it is certain that he was a creative and essential member of the team that created the T-carrier system and launched the digital era of communications.

Fred's involvement with international transmission standards began in the early 1960s when he became chair of Study Group Twelve of the CCITT (International Telegraph and Telephone Consultative Committee, a unit of the International Telecommunications Union that was later renamed ITU-T). Among other accomplishments, he helped define limits on delay performance of voice circuits incorporating satellite links and replacing older subjective methods for rating telephone sets by objective measurements, in particular using a reproducible machine-generated voice-like signal source. This work "led to my involvement with the Communications Society," as Fred explained in his 1999 oral history interview for the IEEE.<sup>1</sup>

ComSoc much later awarded him the Edwin Howard Armstrong Achievement Award (1980) for his pioneering contributions to digital communications and international cooperation (this is the citation for the award he received in 1985). He received the IEEE Award in International Communications (1985) "for his contributions and leadership in the establishment of international transmission objectives and standards." He also won Telephony's Ray Blain Award for Outside Plant Achievement in 1991 and the IEEE Haraden Pratt Award in 1988 "for sustained contributions and commitment to the Institute, particularly for leadership in strategic planning and electronic product development."

His rise in the managerial ranks at Bell Labs began with his T1 accomplishments. In 1956 he was promoted to lead a group

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<sup>1</sup> Andrews FT. 1999. Transcript of Oral History Interview. IEEE Global History Network, available at [www.ieeeeghn.org/wiki/index.php/Oral-History:Fred\\_Andrews](http://www.ieeeeghn.org/wiki/index.php/Oral-History:Fred_Andrews).

applying digital carrier concepts in the local network. Between 1958 and 1982 further promotions and broader responsibilities followed, including transmission planning, military communications engineering, loop electronics development, and switching system engineering. He became a director in 1962, leading the formulation of specifications and controls for voice quality in end-to-end connections across the Bell System network, and an executive director in 1979, responsible for meeting the systems challenges of an evolving digital telephone network. With the AT&T divestiture he was appointed to head the Bellcore vice presidential area responsible for generic requirements and technical analysis of telephone networking equipment used by the Bell Operating Companies, a position he held until his retirement in 1990. Innovations from his area were incorporated in Operating Company specifications, facilitating optimum purchase decisions.

He simultaneously became a leader in his technical community. His ComSoc involvement began in the early 1960s with a working group on telephone testing standards. In addition to terms as chair of ComSoc's Transmission Systems Technical Committee, VP Technical Affairs, board of governors member, vice president and president, he was chair from 1984 to 1990 of the Steering Committee of the International Switching Symposium. Those of us who were active with him in ComSoc remember him conducting board of governors meetings with a calm assurance that gave everyone a chance to participate but kept the meeting moving along.

At the IEEE level, he was, at different times, a member of the IEEE Awards Board and of the IEEE Fellow Committee, chair of the Alexander Graham Bell Medal Committee, chair of the TAB Electronic Products Committee, chair of the IEEE Strategic Planning Committee, and 1992–1993 Division III director on the IEEE Board. In several of these contexts he helped define the IEEE Electronic Library as a functional system and as a business, a large contribution to what the IEEE is today. He also became the first vice president of the IEEE Foundation. Vijay Bhargava recalls, from the time in the early 1990s when he and Fred were both on the IEEE board of directors, that

Fred was a calming influence in the debates over globalization of the IEEE and supported efforts to open an IEEE Singapore office, as well as acting as a mentor to many of his younger board members.

There are fond memories among his colleagues of working and relaxing with Fred. Ralph Wyndrum recalls:

"I am reminded of being in Mississippi, among the biting chiggers on Rte. 468 outside of Brandon. We were there with Fred Andrews, Eric Sumner, Irv McNair, and possibly Hank Hardaway viewing the installation of one of the first T1 line based subscriber loop multiplex systems in about 1972. Fred, always a very professional photographer with a good sense for interesting scenes, took a photo of an old, natural wood ramshackle frame house on a trailer, going by on the highway pulled by a 1950s pickup truck. Fred took several pictures of it as it rolled by, and seeing that we were wondering why, said it must be the home of someone from further out in this rural area who had heard that Brandon was getting upgraded from eight-party to two-party and single-party service, and would be solid evidence of the contribution AT&T and South Central Bell was making to the future of Mississippi! Fred was a great boss, wise, yet humorous, always with valuable and timely advice and willing to take the time to coach his people."

Alan Chynoweth wrote that "No one could have had a finer colleague. When Bellcore was being formed, my decision to join was much helped by knowing that Fred had already agreed to do so." He recalls a golf game during a Bellcore management retreat which he and Fred joined as a learning experience since neither of them had golfed before. "Painfully slowly we hacked our way around from hole to hole, taking many strokes beyond par each time. So, at the next hole, though the preceding players were still on the green, there was no point in us waiting. Fred took a mighty swing and, miraculously, connected so cleanly that the ball went clear as far as the green and landed in the golf cart of our startled colleague, Tom Powers, just as he was driving away. That evening, at the 'awards' dinner, Fred was presented with a mangled golf club."

Not just a technologist, Fred loved the outdoors, particularly the beautiful lakes and forests of the Adirondack Mountains of upstate New York. He was both a participant and an audience member for music and theatrical events in his community. He had acting and other roles in amateur theater productions by the Stony Hill Players in Union County and Wagon Wheel Players in Monmouth County and supported the Paper Mill Playhouse in Milburn, New Jersey. He and his wife, Nancy, sang in church choirs and performed in musical events of their retirement community. As his friend Fox Stoddard commented, "They joined several other BTL and AT&T retirees who also reside there. Tom volunteered on community committees—financial review and operations—where his friendly personality, knowledge, and leadership skills became known to all. He was elected chairman of the residents council, which coordinates and directs all the many community committees. His leadership was greatly appreciated and helped make Fellowship Village [NJ] a wonderful place to live. A memorial service was held at Fellowship Village on September 21, 2013, attended by Tom's family, friends, and BTL/IEEE colleagues."

Fred remained close to his professional community, writing his authoritative T1 history article among other activities in recent years. His friends and colleagues will not forget his initiative, technical insights, and warm personality that had so much influence in creating the infrastructure and professional environment for the vibrant communications industry of today.

