The History of IEEE and Electrotechnologies

Prepared by the IEEE History Center

IEEE History Center
39 Union St., New Brunswick NJ 08901
ieee-history@ieee.org
Since 1884, IEEE has been fostering technical innovation for the benefit of humanity.
1884: The American Institute of Electrical Engineers is founded

A small group of individuals met in New York and founded the AIEE to advance the new field and represent the US at the 1884 International Electrical Exhibition in Philadelphia. Norvin Green of Western Union became the first president.
Communications: The first important electrical technology

Samuel Morse’s first US telegraph line connected Washington and Baltimore in 1844. By 1866, a telegraph cable connected the United States and Europe. Alexander Graham Bell followed in 1876 with a telegraph that talked—the telephone.

Franklin Pope, telegraph operator

Telegraph line congestion

A. G. Bell

1882 Telephone set
A New Industry: Electric Power and Light

Electric power and light systems arose primarily from Thomas Edison’s work. Edison opened his first electric power plant in New York in 1882. Within a decade, electric power had spread to every corner of the globe, with many new applications. The AIEE became dominated by power engineers.

1882
Edison’s first commercial plant, Pearl St., NY

Frank Sprague worked for Edison before leaving to develop the first commercially practical electric streetcar.

1906
Using an electric iron by an electric light

Thomas Edison and his incandescent light patent
AC vs. DC Power

In the 1890s, AC power, championed by George Westinghouse working from inventions by Nikola Tesla, became standard because it could be efficiently transmitted over long distances from massive power plants, such as that built at Niagara Falls, which began sending power to Buffalo in 1896.

Nikola Tesla, inventor of the induction motor and a comprehensive system for polyphase AC power.
The AIEE serves the profession

Through standards, codes of ethics, technical conferences and publications, the AIEE served its members and their growing profession.

First AIEE standard

AIEE Code of Conduct

AIEE badge

Committee report
MIT established the first electrical engineering program in 1882 in the physics department. By the 1920s there were dozens of independent departments in universities across the country, and young engineers typically began their careers with university educations. Curricula were generally heavily oriented towards power engineering.
The Birth of Radio

Radio, a new electrical technology, arose in the first decade of the twentieth century. Wireless telegraphy using spark transmitters was the original application, but particularly after the invention of the vacuum tube amplifier, it began to be used to transmit speech and music.

1901
Guglielmo Marconi and George Kemp with equipment used in transatlantic wireless telegraphy

1912
Radio telegraph operators’ communications with the sinking Titanic demonstrated the power of radio

1922
Triode vacuum tube inventor Lee de Forest with a radio
Formation of the IRE, 1912

With the new industry came a new society in 1912, the Institute of Radio Engineers or IRE, modeled on the AIEE, but devoted to radio, and later increasingly to electronics.
Media Becomes Electronic

In the 1920s, Radio broadcasting swept the world. Between 1921 and 1930 the number of US households with radios grew from close to zero to almost 14 million. And a still newer technology, television, was moving from experiment to reality. IRE members led the way in these developments.

- **1921**
  - WJZ Studio, Newark NJ
  - Vacuum tubes, the first electronic amplifiers, made radio broadcasting and transcontinental telephony possible.

- **1930s**
  - Listening to radio

- **1939**
  - RCA President David Sarnoff opening commercial TV service, NY
AIEE and IRE serve their members and their professions

Both societies ran technical conferences, published journals, promulgated standards, developed codes of ethics, and encouraged the training of student engineers.
Growth of Technological Systems

Increasingly, electrical technologies were applied as part of complex and geographically dispersed technological systems such as electric power grids, globe spanning telecommunications systems, and radio networks.

Transatlantic radio-telephone circuits connected AT&T’s US telephone network with Britain beginning in 1927.

1930s
Transmission lines of the Tennessee Valley Authority brought electricity to a wide swath of rural America.

Orson Welles caused a panic in 1938 when his radio program “War of the Worlds” convinced people listening across the US that Mars had invaded New Jersey.
Governments throughout the world organized their scientists and engineers to devise technologies for use in World War II. This not only contributed to the war effort in areas including radar, computing and weaponry, but produced major advances in technologies from electronics to signal processing that would have broad implications for the succeeding years.

- Colossus, one of the first electronic computers, was among the machines used at Bletchley Park, England to break the German codes.
- Director Dr. Vannevar Bush (center), an electrical engineer, and other members of the US Office of Science Research and Development. The OSRD mobilized and directed US R&D during World War II.
- The OSRD established the Radiation Laboratory at MIT to develop radar into an effective technology for use in World War II.
Solid State Electronics

The transistor and its progeny, the integrated circuit, opened enormous possibilities for new technologies ranging from the iconic portable radio to increasingly powerful computers. Solid state electronics became a hot field in the post war years.

1947
William Shockley, John Bardeen, and Walter Brattain invented the transistor, the first solid state amplifier and switch at Bell Labs

1958
Jack Kilby’s first integrated circuit

1958
Transistor radio

1961
First commercial monolithic integrated circuit, Fairchild
Computers and Computing

By the late 1950s electronic computers had evolved from science fiction to tools for scientific research and large business applications. Alongside rose a new profession, that of the computer engineer.

1943-1946
ENIAC, widely regarded as the first general purpose electronic digital computer. The project was led by J. Presper Eckert and John Mauchly at the University of Pennsylvania.
Organizational Growth and Specialization

Both the AIEE and IRE grew in the post-war period. But the IRE, fueled by increasing interest in electronics, grew much faster. It became the larger organization in 1957. Both institutes increased their scope, forming student branches and groups devoted to different technical specialties. They explored ways to work together.
The idea that there should be one organization for all electrical engineers was an old one, and became more powerful as the profession expanded beyond its separate roots in power and radio. In 1962, the boards and memberships of the two institutes agreed to merge. On January 1, 1963, the IEEE, or Institute of Electrical and Electronic Engineers was born with 150,000 members, 140,000 of whom were in the United States.
Satellites and Space Exploration

The space race began when the USSR launched Sputnik in 1957. Space exploration was heavily based on advances in electronics, including transistors, solar cells, and increasingly powerful computers.

1957
Sputnik, the first space satellite, launched by the USSR

1962
Telstar I, the first active communications satellite, launched by NASA for AT&T yielded the first live transatlantic television transmission.

1969
Buzz Aldrin on the Moon, Project Apollo

1982
NASA mission control, Houston
Microelectronics

As integrated circuits evolved into (among other things) microprocessors, or computers on a chip, the costs dropped dramatically to the point where a student in the early 1970s could own an electronic calculator, and the student of the early 1980s an entire computer. Gordon Moore predicted in 1965 that the number of transistors that could be placed on a single chip would double every two years. Moore’s law has held true for over forty years.
Medical Electronics

While the application of electricity to medicine began in the 19\textsuperscript{th} century, and a few techniques such as X-Rays became standard early in the 20\textsuperscript{th}, applications spread widely beginning in the 1960s in areas from diagnosis to surgery to treatment to a range of computer applications.
IEEE expands its activities

In the 1970s, a variety of crises led many in society to question the worth of technology. Also, employment declined in some technological sectors for the first time since the 1930s. The IEEE responded by starting programs to raise the visibility of its technologies, and by becoming a professional in addition to a technical institution to better serve its members. It also had developed multiple IEEE professional societies to serve the needs of its various communities.
IEEE celebrated its centennial with celebrations of its members’ accomplishments for the betterment of society. By 1984, it was well on its way in its transformation from a United States centered to a global institution.
In the last 25 years, computing and communications have converged. Multiple fiber optic cables sending packet switched information dropped global transmission costs to close to zero. The world became more closely knit into a single global community. Call centers in India served customers in Indiana. Information and commerce traversed the globe via the Internet.
The Globalization of IEEE

IEEE responded to the emerging global village by becoming more global itself. By 2008, 43% of its 375,000 members resided in 159 countries besides the United States.

2003
Students at Nigeria’s Federal University of Technology Werra (FUTO) greet IEEE Spectrum Senior Editor Harry Goldstein

1994
Staff at the IEEE Beijing Section office

2003
IEEE Standards regional web portal
IEEE Today

- More than 375,000 members, including nearly 80,000 student members in more than 160 countries
- 324 sections in ten geographic regions worldwide
- 1,784 chapters that unite local members with similar technical interests
- 1,616 student branches and 452 student branch chapters at colleges and universities in 80 countries
- 38 societies and 7 technical councils representing the wide range of technical interests
- 390 affinity groups consisting of Consultants' Network, Graduates of the Last Decade (GOLD), Women in Engineering (WIE) and Life Members (LM) groups
- Nearly 1,300 standards and projects under development
- Nearly 2 million documents in the IEEE Xplore® digital library
- Publishes a total of 144 transactions, journals and magazines
- Sponsors more than 850 conferences annually
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