The History of IEEE and Electrotechnologies

Prepared by the IEEE History Center

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IEEE
Celebrating 125 Years
of Engineering the Future

Since 1884, IEEE has been fostering technical innovation for the benefit of humanity.

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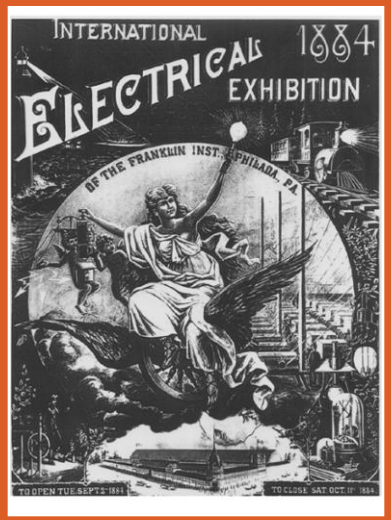
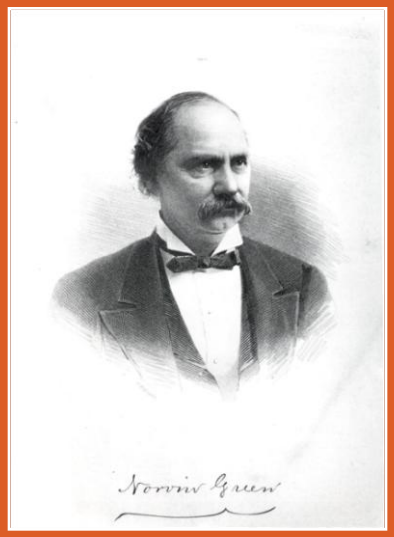
1884: The American Institute of Electrical Engineers is founded

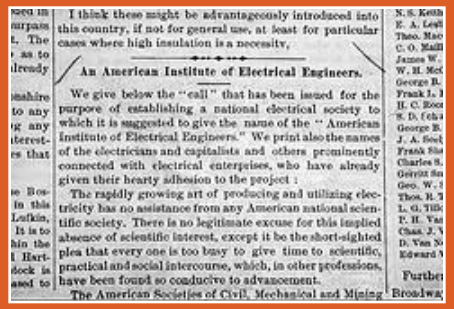
A small group of individuals met in New York and founded the AIEE to advance the new field and represent the US at the 1884 International Electrical Exhibition in Philadelphia. Norvin Green of Western Union became the first president.



Program of the 1884 International Electrical Exhibition, Franklin Institute, Philadelphia



Norvin Green, President of Western Union Telegraph and first president of the AIEE



I think these might be advantageously introduced into this country, if not for general use, at least for particular cases where high insulation is a necessity.

An American Institute of Electrical Engineers.

We give below the "call" that has been issued for the purpose of establishing a national electrical society to which it is suggested to give the name of the "American Institute of Electrical Engineers." We print also the names of the electricians and capitalists and others prominently connected with electrical enterprises, who have already given their hearty adhesion to the project:

The rapidly growing art of producing and utilizing electricity has no assistance from any American national scientific society. There is no legitimate excuse for this implied absence of scientific interest, except it be the short-sighted plea that every one is too busy to give time to scientific, practical and social intercourse, which, in other professions, have been found so conducive to advancement.

The American Societies of Civil, Mechanical and Mining

Invitation to the AIEEE organizational meeting, Electrical World, 5 April 1884

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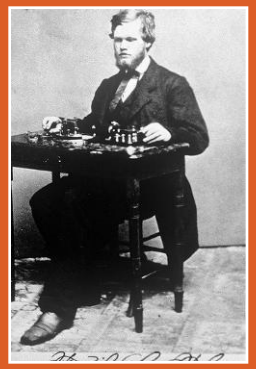
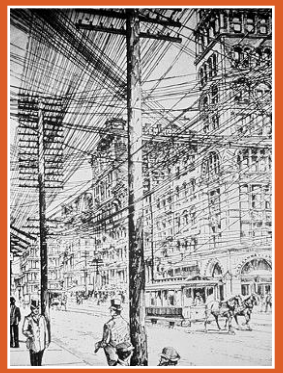
Communications: The first important electrical technology

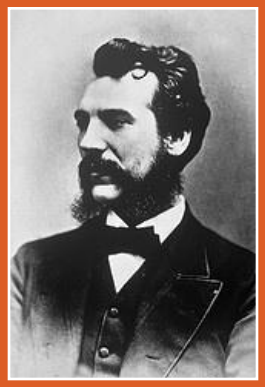
Samuel Morse's first US telegraph line connected Washington and Baltimore in 1844. By 1866, a telegraph cable connected the United States and Europe. Alexander Graham Bell followed in 1876 with a telegraph that talked —the telephone.



Franklin Pope, telegraph operator



Telegraph line congestion



A. G. Bell

1882
Telephone set

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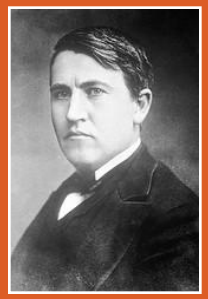
A New Industry: Electric Power and Light

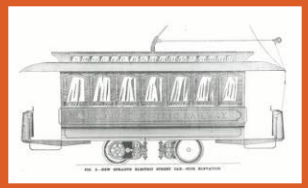
Electric power and light systems arose primarily from Thomas Edison's work. Edison opened his first electric power plant in New York in 1882. Within a decade, electric power had spread to every corner of the globe, with many new applications. The AIEE became dominated by power engineers.

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

1906
Using an electric iron by an electric light



Thomas Edison and his incandescent light patent



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

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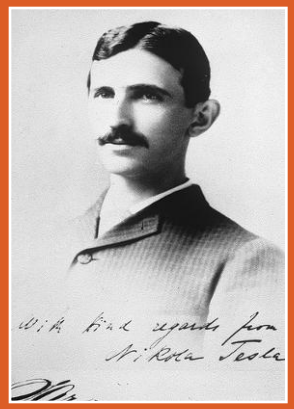
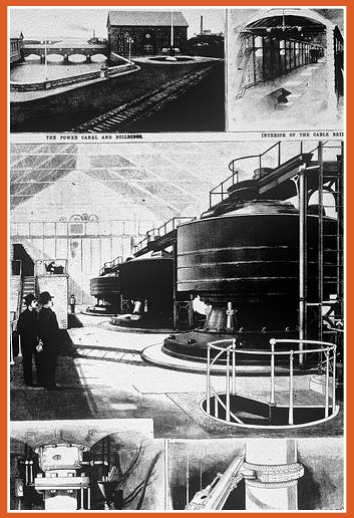
AC vs. DC Power

In the 1890s, AC power, championed by George Westinghouse working form 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.

1905
Power Generation at Niagara Falls



1895
Niagara Falls Power Plant

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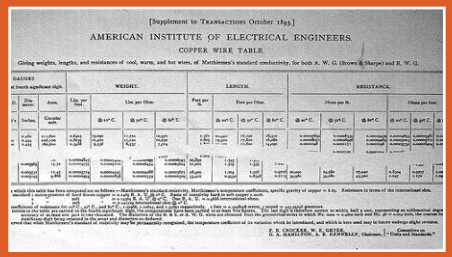
The AIEE serves the profession

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

First AIEE standard



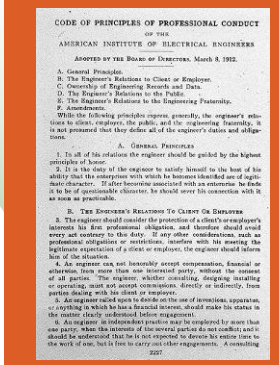
[Supplement to Transactions October 1893.]

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

COPPER WIRE TABLE.

Giving weights, lengths, and resistances of cool, warm, and hot wires, of Matthiessen's standard conductivity, for both A. W. G. (Brown & Sharpe) and B. W. G.

AIEE Code of Conduct



CODE OF PRINCIPLES OF PROFESSIONAL CONDUCT

OF THE

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

ADOPTED BY THE BOARD OF DIRECTORS, March 8, 1912.

A. General Principles.
B. The Engineer's Relations to Client or Employer.
C. Ownership of Engineering Records and Data.
D. The Engineer's Relations to the Public.
E. The Engineer's Relations to the Engineering Fraternity.
F. Amendments.

While the following principles express generally the engineer's relations to client, employer, the public, and the engineering fraternity, it is not presumed that they define all of the engineer's duties and obligations.

A. General Principles

1. In all of his relations the engineer should be guided by the highest principles of honor.

2. It is the duty of the engineer to satisfy himself to the best of his ability that the enterprises with which he becomes identified are of legitimate character. If after becoming associated with an enterprise he finds it to be of questionable character, he should sever his connection with it as soon as practicable.

B. The Engineer's Relations To Client Or Employer

3. The engineer should consider the protection of a client's or employer's interests his first professional obligation, and therefore should avoid every act contrary to this duty. If any other considerations, such as professional obligations or restrictions, interfere with his meeting the legitimate expectation of a client or employer, the engineer should inform him of the situation.

4. An engineer can not honorably accept compensation, financial or otherwise, from more than one interested party, without the consent of all parties. The engineer, whether consulting, designing installing or operating, must not accept commissions, directly or indirectly, from parties dealing with his client or employer.

5. An engineer called upon to decide on the use of inventions, apparatus, or anything in which he has a financial interest, should make his status in the matter clearly understood before engagement.

6. An engineer in independent practice may be employed by more than one party, when the interests of the several parties do not conflict; and it should be understood that he is not expected to devote his entire time to the work of one, but is free to carry on other engagements. A consulting

227

1893

1899

1912

AIEE badge

Committee report

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

Hanoverian Building, 26 Cortlandt Street, New York, N. Y.

June, 1899.

[Supplement 1898.]

REPORT OF THE COMMITTEE ON STANDARDIZATION.

[Accepted by the Institute, June 20th, 1899.]

To The Council of The American Institute of Electrical Engineers.

Gentlemen:

Your committee on standardization begs to submit the following report, covering such subjects as have been deemed of pressing and immediate importance, and which are of such a nature that general agreement may be expected upon them.

While it is the opinion of the committee that many other matters might advantageously have been considered, as, for example, standard methods of testing, yet it has been deemed inexpedient to attempt to cover in a single report more than is here submitted.

Yours respectfully,

FRANCIS B. CROCKER, Chairman.
CARY T. HUTCHINSON.
A. E. KENNELLY.
J. W. LIEB, Jr.
CHARLES P. STEINMETZ.
LEWIS B. STILLWELL.
ELIHU THOMSON.

855

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Electrical Engineering Education becomes established

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.

Early electrical engineering lab, MIT

Professor Dugald Jackson chaired the EE departments first at Wisconsin and then at MIT

Electrical Engineering Class, Cornell U., 1916

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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


THE NAUTICAL GAZETTE

Most Direful Disaster of the Deep

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

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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.

IRE logo

Alfred Goldsmith
IRE Co-founder and first journal editor

IRE annual banquet, NY, 1915. Among those attending were **Tesla**, **Sarnoff**, **de Forest**, and **Alexanderson**

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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.

Vacuum tubes, the first electronic amplifiers, made radio broadcasting and transcontinental telephony possible.

1921
WJZ Studio, Newark NJ

1930s
Listening to radio

1939
RCA President **David Sarnoff** opening commercial TV service, NY

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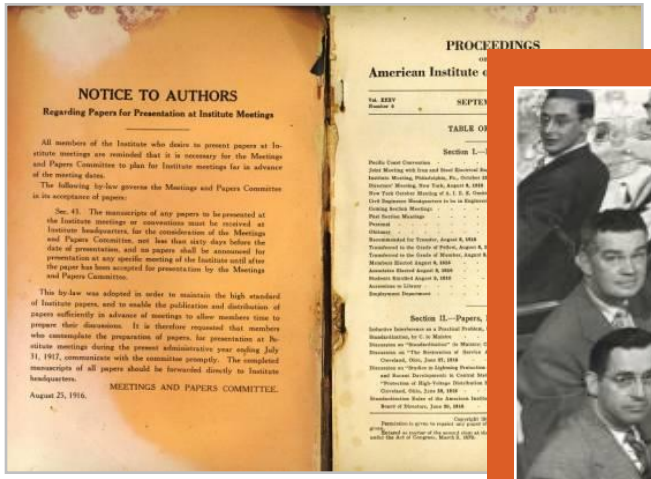
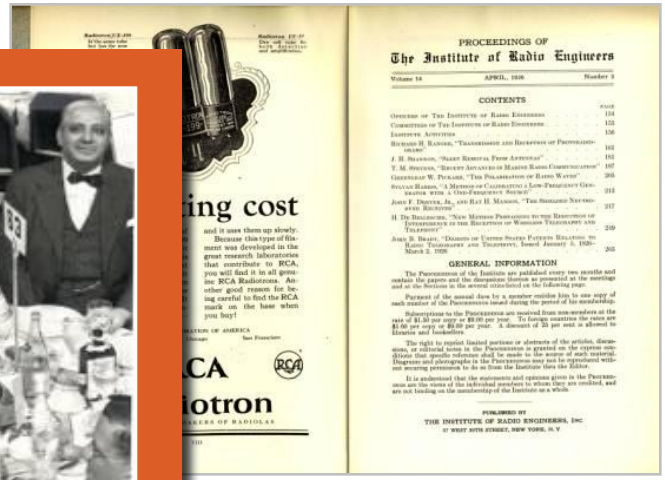
AIEE and IRE serve their members and their professions

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



Proceedings of the AIEE, September 1916

NBC engineers at an IRE banquet



Proceedings of the IRE September 1926

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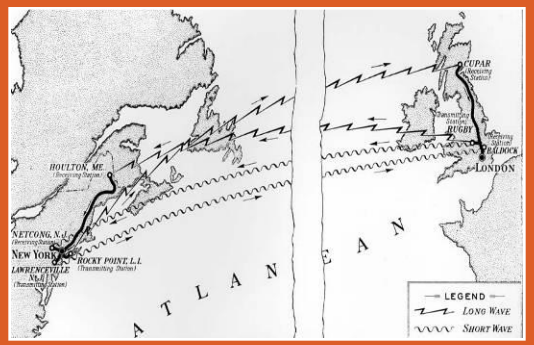
Growth of Technological Systems

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.

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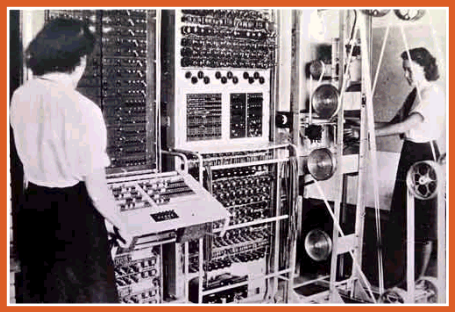
War and Technological Growth

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

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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.

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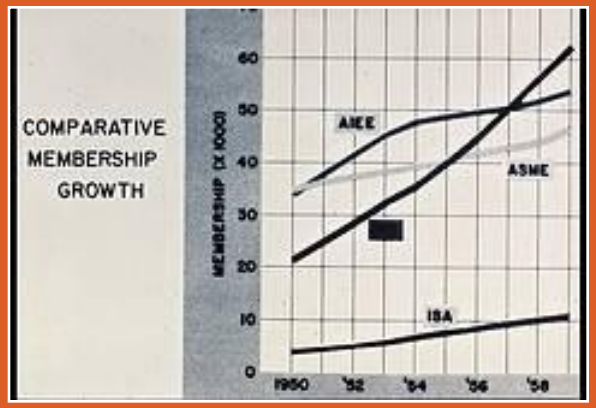
Organizational Growth and Specialization

Both the AIEE and IRE grew in the post-war period. But the IRE, fueled by increasing interest in electronics, grew much faster. It become 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.

Early electrical engineering lab, MIT



1950-59
Engineering Society Growth

1956
Participants in the IRE awards ceremony

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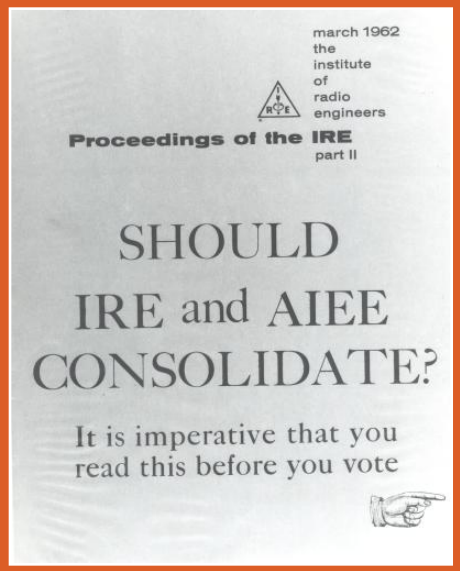
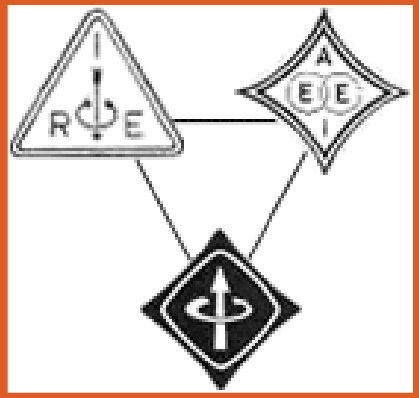
AIEE + IRE = IEEE

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.

1962
Symposium on the proposed merger, IRE National Convention



Special merger issue of the Proceedings of the IRE



The badge of the new IEEE combined the right hand rule from the IRE with the kite from the AIEE

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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

1969
Buzz Aldrin
on the Moon, Project Apollo

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

1982
NASA mission control, Houston

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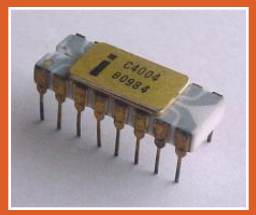
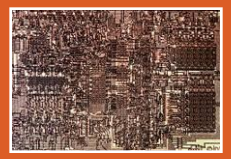
Microelectronics

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.

Andrew Grove, Gordon Moore, and Robert Noyce, founders of the Intel Corporation





Intel's first microprocessor, the 4004 introduced in 1971, contained 2300 transistors on a single chip

1972
Hewlett-Packard HP35 calculator

The Apple II computer, introduced in 1978, brought computing power to desktops.

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Medical Electronics

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

1960
First Implantable pacemaker

1978
CAT scan

1971
A ruby laser in use in surgery

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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.

The Three Mile Island Power Plant in Pennsylvania, which in 1979 was site of the worst nuclear power plant incident in US history.

War Protestors, Boston.

Engineers at XEROX PARC, 1972. Birthplace of the Ethernet, the laser printer, and personal computer

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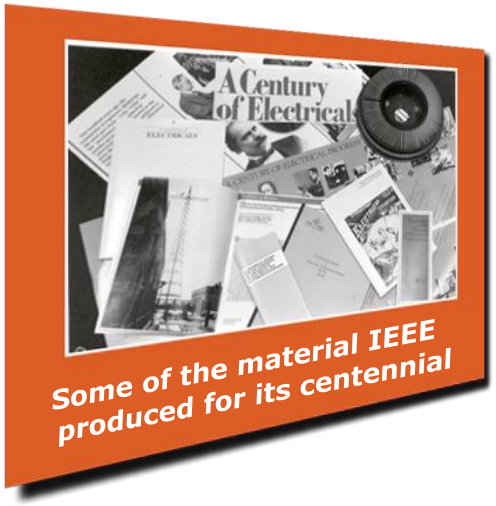
IEEE Centennial 1884-1984

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.



Some of the material IEEE produced for its centennial

1884 1984

A CENTURY OF ELECTRICAL PROGRESS

IEEE

Centennial Logo

1984 Membership distribution

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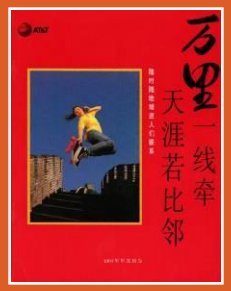
The Global Village

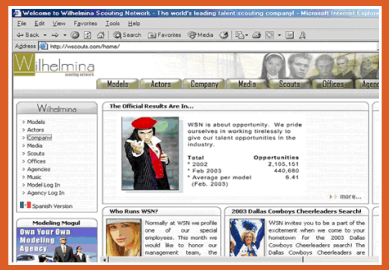
In the last 25 years, computing and communications have converged. Multiple fiber optic cables sending packet switched information dropped global transmission costs to close to zero. The world became more closely knit into a single global community. Call centers in India served customers in Indiana. Information and commerce traversed the globe via the Internet.



1993
AT&T Annual Report, Chinese edition

Optical Fiber

2001
AT&T Global Network Operations Center



Internet website, circa 1996

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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

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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

For further information, or to contribute your own story, visit the IEEE Global History Network *www.ieeeghn.org*

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