Collections Document IEEE's Founding

During the first part of the 20th century, the technical concerns of the American Institute of Electrical Engineers (AIEE), founded in 1884, and of the Institute of Radio Engineers (IRE), formed in 1912, seemed fairly distinct. Generally, the AIEE served those active in wire communications and electric utilities, while the IRE represented those working in radio and electronics. The two societies grew and prospered side by side, sometimes overlapping, but maintaining largely separate identities and interests.

The years after World War II, however, brought dramatic changes to the field of electrical engineering. Electrical technology was moving rapidly; radar, computers, television, solid-state electronics, and space exploration were burgeoning fields. The explosive growth of electronics affected both the AIEE and IRE. IRE membership rates soared, and the AIEE broadened its horizons as the scope of electronics moved into power, control, and communications. By the end of the 1950s, the AIEE was not a society of just power engineers—over 30% of its technical papers were in communications, electronics, or instrumentation.

With greater frequency, questions were raised in both societies about how appropriate it was for the increasingly interrelated fields of electrical engineering to be represented by two large, independent organizations. Merger was becoming ever more logical. Neither society adequately represented the whole breadth of electrical engineering. There was duplication of staff, publications, and activities.

The first step towards a solution came on college campuses; in 1950, the boards of both societies authorized the creation of joint student branches. In 1956, John D. Ryder and Morris Hooven, presidents of the IRE and AIEE respectively, devised a reciprocal membership plan on the national level. In 1958, AIEE president Latimer F. Hickernell and IRE president Donald G. Fink worked out additional arrangements for closer cooperation.

Early in 1961, IRE past president Ronald McFarland and AIEE president Clarence Linder met with each other's board to explain their respective organizations. After these meetings, events moved rapidly. An eight-man joint ad hoc committee was appointed to discuss the specifics of a merger and, by October, the IRE board had authorized a resolution that merger with the AIEE go forward.

The joint merger committee, enlarged to fourteen members in 1962, devised recommendations to be presented to the membership of both societies later in the year. In the election that followed, 87% of the voting members of each society approved the merger. On 1 January 1963, the Institute of Electrical and Electronics Engineers was officially born.

The events and decisions leading to the founding of the IEEE are documented in the merger archives, part of the collections of the Center for the History of Electrical Engineering. Among the over 1,000 documents are meeting minutes, committee papers, news clippings, statistics, legal and financial documents, and correspondence on the merger. Topics covered include intersociety relations, the various merger committees and study groups, technical and organizational operations, publications, and individual views both for and against the merger. This document collection is supplemented by oral history interviews conducted with three members of the joint merger committee. These in-depth talks with Ronald McFarland, John Ryder, and B. Richard Teare provide a unique personal perspective on the formation of the IEEE.

The merger archives are open to researchers by appointment. For further information, contact the Center for the History of Electrical Engineering.
Edison Photos Donated to Smithsonian

In a ceremony held on 11 February, Edison’s birthday, James Williams, Vice President of the Testing Laboratories, presented ten albums of Edison photographs to the Smithsonian Institution’s National Museum of American History (NMAH). They were accepted by Douglas Evelyn, Deputy Director of the Conservation Center, and Moellel, Chairman of the Dept. of the History of Science and Technology. The albums were discovered in the company’s archives. Today, now an independent conservation and certification laboratory in Corland, NY, ET’s history is linked with Thomas Edison, the lab was founded in New York City in 1892 to test Edison incandescent lamps.

When the majority of the photographs contained in the albums were taken, Edison was already a legend. These images clearly show the public spotlight in which the inventor lived the second half of his life. Whether camping with Henry Ford and Harvey Firestone or receiving the Congressional Medal, the central interplay between the artifacts and their personal lives. My dissertation will attempt to advance this understanding through a close study of the National Bureau of Standards’ (NBS) computing effort, in order to illuminate the solution to key questions in the development of the electronic digital computer.

Meetings

BSHS-SSS Anglo-American Conference

The British Society for the History of Science and the History of Science Society will hold an Anglo-American Conference in Manchester, England, during 11-15 July. Sessions have been scheduled on Business, Science and Technology. Recent Work on the History of Industrial Research, Science and the Military, The History of Computing, and Science-Technology Relations in Nineteenth-Century Britain. These will include the following papers of interest to Newsletter readers:

• Colin Hempstead, “Telegraphy, Science and Technology”
• Benjamin H. Fried, “Magnetic Telegraphy and British Field Theory”
• Alan Morton, “The Laser-Scanner Supermarket ‘Beep’ Sound”
• Arthur Norberg, “Punching Cards to Magnetoresistive sensors: Industrial Research and Development’s Role in Changing Machine Construction Motor”


For more information, contact: J.V. Pickstone, Centre for the History of Science, Technology, and Medicine, Mathematics Tower, University of Manchester, Oxford Road, Manchester M13 9PL, England

IEEE Fellowship in Electrical History Awarded

The 1989-80 IEEE Fellowship in Electrical History, supported by the IEEE Life Member Fund, has been awarded to Michael A. Gundersen, 3 PhD, for his contributions to electrical history. In the Dept. of Science and Technology Studies at Rensselaer Polytechnic Institute, Mr. Gundersen is currently planning a dissertation on the computing activities of the National Bureau of Standards as a case study in the history of computing. He writes:

The origins of electronic digital computing are all poorly understood. While we know a great deal about the internal design of the computer, the forces shaping this development are still obscure. Computing history is ready to work outside the technical facts into their social context in an exploration of the abilities and access to materials and funding through his father, the Speedwell Iron Works in Morristown, NJ, were instrumental in developing a practical telegraph.

Two miles of wire were strung around a vacant room at the Speedwell Works and the telegraph was set up for a public demonstration on 11 January. The public reception to Morse’s system born in 1838. Morse and Volt unswervingly pursued recording electromagnetic telegraph.

In October 1832, Samuel Morse was on his way home from Europe aboard the Sacy. He impugned shipboard conversation about the properties of electricity planted, as Morse said, “the crude seed which at once took root, and . . . grew into form . . .”. By the time he arrived in New York in May 1837, he had sketched out a rudimentary plans for a recording telegraph.

For the next two-and-one-half years, however, painting, politics, and poverty combined to keep Morse from building the instrument. Moreover, the materials needed were not readily available, as Morse pointed out: “The electro-magnet was not an instrument found for sale in the shops. . . . For where to be obtained, except in the smallest quantities, and at a cost of iron wound with cotton thread.” So, he improvised, insulating copper wire by winding cotton thread into tubes of wood that would the electromagnet (an iron bar with the bars, he insulates the works from a wooden clock to move the paper, and arranging it all on a canvas surface, and the table. The result was rather unsatisfactory and time too unreliable to test Morse’s theory. By the end of 1835, Morse was able to record on paper a message sent through a wire.

Finally settled, as professor of art and design at the University of the City of New York (now New York University), Morse worked on improving the telegraph. His collector of New Orleans, Robert C. Beale, became Morse’s partner. Familiar with the writings of Joseph Henry, Beale advised Morse to make two important changes to his apparatus: replace the single photograph of some of many cells and increase the number of turns of wire around the electromagnet. Although the accelerations dramatically increased the distance messages could be sent.

On 2 September 1837, Alfred Vail, a student at the University of Philadelphia, to see one of Morse’s demonstrations of the telegraph, he soon became Morse’s second partner. Vail’s mechanical special events.

To celebrate the sesquicentennial of the telegraph, several special events have been scheduled throughout the year. These include the dedication of an Electrical Engineering Milestone for Morse and Vail’s work at Speedwell and a special commemorative conference, sponsored by the IEEE Communications Society.

On 7 May, Samuel Morse and Alfred Vail’s public demonstration of practical telegraph at Morristown will be dedicated as an IEEE Electrical Engineering Milestone. The ceremony will be held at the site, now part of Historical Speedwell in Morristown, in which Morse and Beale conducted their experiments and demonstrations.

Telecom at 150: Progress, Promises, and Policies will be held on 21-22 June at the Merrill Lynch Conference Center in Princeton, NJ. This conference for key leaders in telecommunications will provide a forum for a "wide-angle" view of current and "historical perspectives relevant today."

For more information on either of these events, please contact the Center for the History of Electrical Engineering.
MIT Society Celebrates Hertz Centennial

One hundred years ago, the widely-held belief that electromagnetic forces acted instantly between objects at a distance collapsed when Heinrich Hertz proved that all forms of electromagnetic radiation were propagated as waves at a finite velocity—the speed of light.

With the completion of this series of experiments, begun in 1886, Maxwell’s theory was verified. Hertz’s work with what came to be called radio waves will be the focus of two special events during the IEEE Microwave Theory and Techniques Society International Microwave Symposium to be held in New York City on 25-27 May.

A special session of historical papers will be held during Symposium. Scheduled speakers include:

- James E. Brittain, “The Legacy of Hertz: Some Highlights in Microwaves History from 1895 to 1945”
- Robert S. Elliott, “The History of Electromagnetics as Hertz Would Have Known It”
- Helmut Friedberg, “Heinrich Hertz at Work in Karlsruhe”
- John D. Kraus, “Heinrich Hertz—Theorist and Experimentalist”
- Charles Suskind, “Heinrich Hertz: A Short Life”

The session will be videotaped and several of the papers will be reprinted in the May 1998 issue of the IEEE Transactions on Microwave Theory and Techniques.

The Hertz celebration will also include a unique exhibit designed to show Hertz’s experimental method. Organized by John H. Bryan, an adjunct research scientist at the University of Michigan at Ann Arbor, the exhibit will present Hertz’s experiments chronologically, using a set of replicas of his original apparatus on loan from London’s Science Museum. By combining the artifacts with text, graphics, and an illustrated catalogue, written by Bryan, the exhibit will offer visitors a chance to follow Hertz’s thinking and progress, his successes and failures.

Like many of his contemporaries, Hertz was intrigued by the questions on the nature of light, electricity, and magnetism first raised by Michael Faraday and elaborated on by James Clerk Maxwell. In “A Dynamical Theory of the Electromagnetic Field,” published in 1865, Maxwell wrote, “...we have strong reason to conclude that light itself (including radiant heat, and other radiations if any) is an electromagnetic disturbance in the form of waves propagated through the electromagnetic field according to electromagnetic laws.”

He developed this idea in his 1873 ‘A Treatise on Electricity and Magnetism’ in which he brought together the elements of his theory in a single work. Part of this theory implied the existence of electromagnetic waves other than light which would be generated by any acceleration of electrical current. These waves would travel through space at the same speed as light, but at different wavelengths.

In setting out to prove these ideas, Hertz not only had to find a way to detect such waves, but also had to devise a method of generating them. He then had to be able to measure their wavelength in order to compute velocity, the product of wavelength and frequency.

He began his experiments simply with a pair of ‘Rie’s’ or ‘Knochenhauer’ spirals—wire coils equipped with a spark gap. When he discharged a Leyden jar through one of the coils, he observed sparks in the second. He knew that the spark gap acted as a switch and that the discharge of a Leyden jar was oscillatory. But when he found a central point in this secondary conductor, he determined that the oscillations obtained were regular. Hertz now had a basic source of electromagnetic waves and, in the second coil, a rudimentary receiver.

He modified his basic experimental setup, replacing the Leyden jar and Knochenhauer spirals with an induction coil and spark gap to generate the waves and a wire loop fitted with a small spark gap to detect them. With these less elements of apparatus, he continued his experiments using what he called “this new class of oscillations.” He discovered the ability of ultra-violet light produced by an electrical spark to cause reciprocal sparking in another conductor. He investigated effects both on and caused by insulators. He set up experiments to test the idea that the waves were all propagated at a finite velocity. At first, his results seemed to point to an infinite velocity of propagation, and then to a faster rate in air than in wire. But, to Hertz, these ideas made no sense.

The breakthrough came during further experiments with waves in wires. In the course of measuring the results of trials with various configurations of wires, he noticed that he was able to observe the actions of very short waves. He repeated his earlier experiments using a wavelength of about 60cm (just under 2 ft) and found the velocity of propagation of the waves in wires to be very nearly equal to that in air. He then conducted experiments on the polarization, reflection, diffraction, and refraction of the waves, showing that the experiments were systematically carried out on light. His final set of experiments verified the theory that electric waves were also waves of magnetic force.

Hertz supplemented the reports of his experimental researches with theoretical papers on his work. All of these writings were gathered together in 1895 in one volume, Untersuchungen uber die Ausbreitung der Elektrischen Kraft. The book was translated into English the following year and given the title, Electric Waves, being Researches on the Propagation of Electric Action with Finite Velocity Through Space. In the introduction, Hertz summarized the importance of his work, the propagation in time of a supposed action-at-a-distance is for the first time proved. This fact forms the philosophic result of the experiments; and, indeed, in a certain sense the most important result. The proof includes a recognition of the fact that the electric forces can disentangle themselves from material bodies, and can continue to subsist as conditions or changes in the state of space. The details of the experiments included... But as long as Maxwell’s theory depended solely upon the probability of its results, and not on the certainty of its hypotheses, it could not completely displace the theories which were opposed to it... In this connection we can best characterise the object and the result of our experiments by saying: The object of these experiments was to test the fundamental hypotheses of the Faraday-Maxwell theory, and the result of the experiments is to confirm the fundamental hypotheses of the theory.

Like and electromagnetic waves were part of the same continuum, traveling through space at the speed of light.

At the close of the MIT Symposium, the Hertz exhibit will be mounted at the MIT Museum, 265 Massachusetts Avenue, Cambridge, MA 02139 (617-253-4444) through 1998.

The Newsletter of the IEEE Center for the History of Electrical Engineering is sent three times a year free of charge to engineers, historians, and others with an interest in the history of electrical science and technology. If you have not already done so, please complete the form below and return it to the Center to be certain of receiving future issues.

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“Masterpieces of Moving Image Technology”

The American Museum of the Moving Image (AMMI), which is devoted to the history and art of motion pictures, television, and all other moving image media, will open the exhibition, “Masterpieces of Moving Image Technology,” on 10 September 1988. The exhibit includes some sixty historic artifacts of film and television technology, from pre-cinema optical toys of the early-nineteenth century to the latest SONY compact CCD (charge-coupled-device) camera.

While recent work by media critics and historians has begun to emphasize the web of relationships that link motion picture and television programming, historians of technology continue to treat the development of these two media as discrete projects. Dr. Richard Koszarski, AMMI’s Curator of Film, has organized many of the artifacts in this show in non-traditional groupings which underscore common solutions to shared technical problems—problems often generated by programming demands or audience requirements not unique to either medium. The development of color, for example, is illustrated by the CBS Field Sequential Television system and the early Kinemacolor motion picture process, both of which were additive processes employing synchronized color wheels on both camera and projector/receiver. Later color developments are also shown, including Technicolor and RCA’s first “shadow mask” CRT receiver. News gathering and sound recording are also treated as common problems addressed by both technologies.

A special section of the exhibit highlights the career of C. Francis Jenkins. First president of the Society of Motion Picture Engineers, Jenkins was one of the few pioneers to make important contributions to both media. Jenkins’s early Phantoscope projector, his Prismatic Disc system of image scanning, and one of his commercial television receivers of 1930 will be shown.

Artifacts in the exhibit are drawn from the AMMI collections, various private and corporate lenders, and many other museum collections, including those of the George Eastman House/International Museum of Photography, the Henry Ford Museum and Greenfield Village, the Edison National Historic Site, the Franklin Institute, the Stanford University Museum of Art, and the Smithsonian Institution. “Masterpieces of Moving Image Technology” will be on display through March 1989. For more information, contact Richard Koszarski, Curator of Film, American Museum of the Moving Image, 35th Avenue at 36th Street, Astoria, NY 11106 (718-784-4520).