Region 1, IEEE, and the Electrical and Electronics Revolution

We have met here in Philadelphia where the first meeting of the American Institute of Electrical Engineers (AIEE), one of the two founding societies of the Institute of Electrical and Electronics Engineers (IEEE), was held on October 7th and 8th of 1884. It is fitting that part of this years 125th anniversary be held where it all started. As historian for Region 1 of IEEE I want to describe our significant activities in the development and growth of our great technical and professional society, and the great revolution in electricity and electronics that occurred in Region 1. If you are unfamiliar with the area of Region 1 of IEEE, it includes all of New York, New England, and 13 counties of Northern New Jersey from the Princeton area north.

The AIEE was organized in Region 1, in New York City, at the offices of the American Society of Civil Engineers, (ASCE) on May 13, 1884, which is our anniversary date. The International Electrical Exposition was scheduled in Philadelphia that year. Several of our leading electricians of the time (yes we were called electricians then!), were alarmed that foreign electrical dignitaries would be attending the Exposition, and that The United States did not have an electrical technical society to welcome them. This concern became a catalyst to 25 prominent individuals in electrical technology to issue a call to form a society. Of the 25, several members of the group were from our Region 1, including: Ralph Wainwright Pope, Great Barrington, MA; Charles A. Cross, Boston, MA; Thomas Edison, New York, NY; George Hamilton, New York, NY; T. Commerford Martin, New York, NY; Theodore Vail, Boston, MA; Edward Weston, Newark, NJ; George Prescott, New York, New York; and Elihu Thompson, Swampscott, MA. The first technical meeting of AIEE was held as part of the Philadelphia Exposition on October 7th and 8th, 1884. These individuals were not only founders of the Institute, but you can immediately recognize that they also invented, developed, and reduced to practice the many devices that electrified the world during the past 125 years.

Thales of Rhodes, Greece discovered static electricity as early as the 6th century BC, but electricity remained mainly a laboratory curiosity until the mid 1700's. One of the first major developments was a direct current battery called the Voltaic pile, which was invented by Alessandro Volta in Italy, in 1800. Note that batteries were too expensive to use for most

commercial applications, but did find a practical application when they were used to power telegraph systems.

Telegraph experiments had been done in laboratory environments as early as 1774, by Lesage, in Geneva, however, the first really successful demonstration of telegraphy was conducted by Samuel F. B. Morse, from Region 1, between Washington and Baltimore on May 24th 1884 using his newly invented Morse Code. . The message was "what hath God wrought?" The most important discovery occurred in the fall of 1831 when Michael Faraday discovered electromagnetic induction, which ushered in the electrical power age. Note that almost all electrical generation other than batteries, for generating and transmitting electricity rely on this technique. Werner Siemens a German Engineer discovered the dynamo-electric principle in 1866. Charles Brush in Cleveland constructed a hand built dynamo in the United States in 1876. Brush also perfected the arc light in the 1860 era. The design consisted of two vertical carbon electrodes which when heated and drawn together emitted a brilliant arc. His dynamo was driven by a steam engine and could light up small areas.

By 1879, Thomas Edison, an AIEEE founder had developed a practical carbon filament incandescent lamp. By 1882 he had developed the first incandescent lamp station in the US at the Pearl Street Station in New York. The station employed 6 "giant" dynamos (the largest ever constructed), which supplied 7200 16 candlepower lamps over an area of 1/6 of a square mile. The station could not only provide lighting but the power to drive motors, fans, printing presses and heating appliances. Unfortunately, the range of one d-c generating plant was limited to approximately a range of 1 square mile due to the fact that as the current is doubled the heat loss is of course quadrupled. If the voltage was increased to obtain greater range the people near the generator complained their lights were burning out too rapidly, whereas those further from the generator could not get enough light to read by!

During the same era George Westinghouse had started pursuing alternating current and purchased the patent for an a-c transformer from Lucien Garland and John Gibbs. He then employed Nikola Tesla an Austrian-Hungarian, and inventor in ac, who graduated from the University of Prague and William Stanley an AIEE Fellow from Pittsfield, Massachusetts. Stanley had the mission of demonstrating that ac was a practical electrical system. In 1886 Stanley constructed the first successful

commercial transformer and other required a-c electrical devices necessary to electrify the city of Great Barrington, MA. The a-c power was stepped up to 500 volts, transmitted 4000 feet to the center of town and stepped down for lights and power. Stanley also demonstrated that transformers could be connected in parallel and designed as self -regulating. There was a problem with a-c motors. Because of the pulsating character of the energy supplied by ac, the motors would stick on “dead center.” Tesla invented a polyphase motor where the current to the motor was supplied by a generator with two separate windings displaced by 90 electrical degrees to provide a two-phase current. A rotor winding placed within this field was magnetically energized by induction and the resulting interaction of the 2 magnetic fields caused the rotor to revolve in unison with the rotating magnetic field of the station resulting in an induction motor. In a series of history making patents, Tesla demonstrated a polyphase a-c system consisting of a generator, the transformers, the transmission layout, the induction motor and the lights. The next step the Westinghouse group took was to contract to provide lights for the Chicago Exposition in 1893. Twelve 25 ton polyphase generators were built that provided 12,000 horsepower of electrical energy. Fair attendees were totally awed by the electrical spectacle. Not only were the buildings and grounds brightly lighted, but all power for fair operation was provided by a-c electrical power. This included: hundreds of machines; cars and locomotives; elevators; large fountains; and the sewer system. This clearly demonstrated to the world that electricity was a practical energy source.

Niagara Falls and its tremendous power, estimated to be Fifty million horsepower had long been considered for exploitation, but no method had been found to transmit the power any distance from the falls. In 1889 an international commission of five distinguished scientists, lead by Lord Kelvin, was organized. Cataract Construction Company had the contract to harness the power and considered: compressed air, water, mechanical means or electricity. Due to the proven success of Tesla and Stanley in demonstrating a-c, this technique was chosen and Westinghouse Electric won the contract to build a polyphase a-c system at the falls in 1893. On April 1, 1895 the first 5000 horsepower turbo-generator was completed, and on August 26, 1895 the Adams Hydroelectric Generating Plant went into operation. In 1896 two transmission lines were constructed from Niagara to Buffalo, 22 miles from the falls, clearly demonstrating the advantage of high voltage a-c for long distance power transmission.

In this last decade of the 19th century the electrification of America had begun, with Edison demonstrating d-c power with his large dynamos and incandescent lamps, and Tesla proving polyphase a-c with his transformers and induction motors. It was inevitable that the two would clash, and their strong disagreement was called "The Battle of the Currents." Edison wanted to ban a-c, which he considered unnecessary and dangerous to life and property. The danger of ac was demonstrated when Auburn, NY Prison performed the first electrocution of an inmate with 2000 volts of ac. This was used by Edison as proof that ac was really dangerous. Tesla pointed out that with d-c that a powerhouse would be required every square mile, since power could not be transmitted further. This would result in a prohibitive cost for an electrical system. The feud became so personal that when the Nobel Prize was offered jointly to Tesla and Edison, Tesla refused it and it was instead awarded to a little known scientist, Niles Gustav Dalen for his work on illumination by gas. Tesla did have a relationship with the AIEE. In May 1888 he received an invitation to provide a speech on his a-c power system approach. His speech was so awe inspiring that he received a standing ovation by the engineers present. In 1917 Tesla was given the AIEE Edison Merit of Achievement Medal, which he first refused. He said, " If I had the money to spend on such nonsense, I would award a Tesla Medal to Mr. Edison! He later relented and accepted it!

Before leaving Edison, we need to discuss what was probably his greatest discovery, practical thermionic emission, which became known as the "Edison-Effect." He was trying to correct carbon buildup in his lamps and produced a globe in which electrons passed from one electrode to another – the first vacuum tube! This was the first and essential step in the emergence of electronics.

Other founders and later presidents of AIEE were also pioneers in electrical advancement. Alexander Graham Bell, another founder of AIEE, was elected the President of AIEE, in 1891-92. His famous invention was the telephone, which was accomplished on March 10, 1876. His first message to his assistant who was elsewhere in the office, was, "Mr. Watson, come here I want you." Bell's telephone was demonstrated that same year, as part of the Philadelphia centennial celebration to celebrate the 100th anniversary of the signing of the Declaration of Independence. Brazilian Emperor, Pedro II, was so surprised that he dropped the phone! He cried out, "My God, it talks!" By 1877 The Bell Telephone Association was

organized and transmitters and switchboards were developed. By 1900 one million miles of long distance lines were installed, and half the people within the US were within talking distance. Another source states that by 1900 one in every fifty people in the US had a telephone!

Two brothers from Great Barrington MA were very active in the telegraphy business and the formation and development of the AIEE. They were, Ralph Wainwright Pope, and Franklin L. Pope who both were involved in the Collins Overland Telegraph Expedition in 1865, which hoped to provide service to Europe through Alaska and Siberia. This program was quickly disbanded when the Atlantic cable was completed in 1866. Ralph, as previously mentioned, was an original AIEE founder. Ralph also worked in the New York Office of American Telegraph Company. He became AIEE Institute Secretary in May 1885, and continued to be reelected to the post until he resigned in 1911. He is credited with first suggesting that the Institute form local sections. Franklin Pope was elected as the second president of AIEE in 1886-87. In 1869 Franklin entered into a partnership with Thomas Edison, under the name: Pope, Edison and Company, Electrical Engineers. He also worked with George Westinghouse, Elihu Thompson and William Stanley in the development of ac during the 1880 time period.

T. Commerford Martin was elected President of AIEE in 1887-88. He was Secretary and a founder of The National Electric Light Association (NELA) in 1885. He was instrumental in obtaining $1,500,000 from Andrew Carnegie for the Engineering Societies Building (ESB) and Engineers Club. Charles Scott, President in 1902-03, also obtained funds for the ESB, which became the United Engineering Society in NY in 1904. On April 15, 1915 the ESB was reorganized as the United Engineering Foundation, which it remains today, and is located at 3 Park, Avenue, New York City. It is the headquarters of the founding societies: the American Society of Civil Engineers (ASCE); the American Institute of Mining and Metallurgical Engineers (AIME); the American Society of Mechanical Engineers(ASME); the Institute of Electrical and Electronics Engineers (IEEE); and the American Institute of Chemical Engineers (AIChE).

Edward Weston, another founder, was elected President of AIEE in 1888-89. He formed the Weston Company in Newark, NJ in 1877 and consolidated it with the U. S. Electric Light Company in 1881, where he had the title of electrician. Weston received many patents in dynamo construction, and one of his greatest projects was the installation of arc lights

on the newly completed Brooklyn Bridge in 1883. During his many electrical developments he had great difficulty in making electrical measurements with the clumsy, slow acting, and huge instruments then available. In 1888 he organized the Weston Electrical Instrument Company, in Newark, NJ, where he invented and developed exceptionally precise electrical measurement instruments of high speed, high accuracy, and easy portability.

Elihu Thompson was also a founder, and was elected AIEE President in 1889-90. Professor Thompson, a title used by his peers, had over 700 patents, which covered nearly every field of electrical activity. Thompson started as a professor of chemistry at Philadelphia Central High School where he taught with Edwin J. Houston. They formed the Thompson-Houston Electric Company in Philadelphia in 1879, moved to New Britain, CT in 1880 and to Lynn, MA in 1883. They merged with the American Electric Company, in Lynn, MA in the latter move. Their first important invention was the three-coil arc dynamo, which with its automatic regulator was utilized in the successful electrical lighting system developed in 1880. In 1885 Thompson devised the use of a grounded secondary for transformers, overcoming the danger of transformer insulation breakdown. This resulted in a strong impetus for the development of ac distribution systems. During this period he also developed a dc dynamo for incandescent lamps. In 1887 he built the first repulsion-induction motor. In 1888 the company installed the first industrial electric locomotive in Lowell, MA. The company merged with the Edison General Electric Company in 1892 forming the current General Electric Company.

Edwin Houston was also active in the AIEE, becoming the President in 1893 through 1895. Houston was very active in the formation of the AIEE and was appointed a member of the United States Electrical Commission, which convened in Philadelphia in 1884. The Franklin Institute elected Houston Chief Engineer for the 1884 Philadelphia International Electrical Exhibition, where AIEE held its first meeting.

Frank J. Sprague was AIEE President in 1892-93. He was very active in the development and operation of electric trolley, the constant speed motor, the multiple unit, regenerative and remote control systems, and considerable equipment for electrical, high-speed elevators. He devised a mathematical system for determining the characteristics of central station distribution of electricity. He worked with Edison for one year and then

formed his own company, the Sprague Electric Railway and Motor Company.

Francis B. Crocker was AIEE President in 1897-98, and in 1899 he founded the Department of Electrical Engineering at Columbia University. In 1883, with Charles Curtis he organized the firm of Curtis and Crocker, one of the earliest electrical motor manufacturing concerns. In 1888, due to the ill health of Curtis he organized, with Schuyler Wheeler, the firm of Crocker and Wheeler, Electrical Engineers, which was the forerunner of the Crocker Wheeler Company. Dr. Crocker gave much of his time as an advocate of national and international standardization of electric equipment. In 1890 he became Chairman of the first standardization committee of AIEE, serving several terms.

In 1887 Arthur E. Kennelly came to the US from London and became the principal assistant to Edison. He was AIEE President from 1898-1900. In 1902 he became professor of Electrical Engineering at Harvard, and became professor emeritus in 1930 at Harvard and the Massachusetts Institute of Technology. He was very active in telephone research specifically in the mathematical treatment of transmission lines.

Charles P. Steinmetz came to the US in 1889 and was employed as a draftsman for the Osterheld and Eickemeyer (O&E) in Yonkers, NY. In 1892 Edison General Electric Company of NY, NY, and the Thompson Houston Company of Lynn, MA, merged forming General Electric. O&E was purchased, and Steinmetz was sent to Lynn and in 1894 to Schenectady, where he served as chief consulting engineer of the new GE. An Employees Engineering Society was formed at Schenectady GE in 1898, and rapidly grew and merged with AIEE as a Section in 1903. Steinmetz served as the first Chair and continued for 3 years. He possessed a great insight into scientific phenomena and an unequaled ability to conduct and explain the most difficult and abstruse electrical problems by systematic mathematical methods. He published many scientific papers and books, including a book on hysteresis, which is considered a classic on the subject. His abilities are highlighted by a report circling through the company that engineers with complex electrical mathematical problems went to Dr. Steinmetz and he could calculate an answer in his head while they stood at his desk! The GE strong considerations for Steinmetz are proven by the fact that portraits of him hang beside Edison in the GE welcoming center at the Schenectady Works. Steinmetz was AIEE President in 1901-02, Vice-President in 1896-98, Manager in 1892-95, and 1898-1901.

There were a number of inventions or developments in electricity in Region 1 that have been reported or listed as a Milestone by the IEEE History Center that were not reported above.

1. A practical electric motor developed by Thomas Davenport, a blacksmith in Rutland Vermont in 1837.
2. A commercial electric fan developed by Crocker and Curtis Company in New York, NY in 1882.
3. An electric iron developed by Seely in New York, NY in 1882.
4. Mass production of Edison lamps by Elihu Thompson in Lynn, MA in 1885.
5. Development of South Boston Power Station (by many contributors) in 1891 in Boston MA.
6. Development and construction of an electric escalator on Coney Island, NY, NY, by Reno in 1893.
7. Wireless Power Transmission by Nicola Tesla in NY, NY in 1898.
8. Development of the oscilloscope in Ithaca, NY by Ryan in 1902.
9. Development of mercury discharge lamp in NY, NY by Cooper-Hewitt Company in 1901.
10. Development of tungsten filament by William Coolidge in Schenectady, NY in 1910.

The Institute of Radio Engineers (IRE) was organized in 1912. The IRE grew out of the merger of two earlier wireless organizations: The Society of Wireless Telegraph Engineers (SWTE), which was formed in 1907, in Boston, by John Stone; and The Wireless Institute (TWI), which was organized in 1909, by Robert Marriott, and had its first meeting held at the Engineering Society in New York. The two organizations had a severe loss in membership and decided to try to salvage their organizations by joining. Marriott was the first President of IRE in 1912, and John Stone was the fourth President in 1915. Stone was with American Bell Telephone in Boston from 1890-1900, where he invented the Stone common battery system, the carrier current system of transmission over wires and uniformly loading telephone cables with inductance.

Arthur Kennelly was President of IRE in 1916. He was an assistant to Thomas Edison and consultant to GE from 1886-1894. Kennelly was the first to suggest that the ionized conducting layer in the upper atmosphere was responsible for the reduction of attenuation of radio signals at great distances.

Michael Pupin was IRE President in 1917. In 1896 Pupin discovered that x-ray photos could be taken in a fraction of a second by interposing a fluorescent substance between the photo plate and object to be photographed. Prior to his discovery an x-ray photo could take over an hour. He also developed the approach of inserting induction coils at periodically recurring points along long telephone lines which eliminated any limits to distance telephony, when used with vacuum tubes.

Ernst Alexanderson was IRE President in 1921. He was consulting engineer for GE, Schenectady, NY from 1902-1920. In 1920 he was the Chief Engineer for Radio Corporation of America (RCA). He designed the Alexanderson high frequency alternator, a system of cascading radio frequency amplifier stages and a magnetic amplifier for radiotelephony. The alternators had a frequency range to 100 kHz and a power capability of 2 kW to 200 kW.

Irving Langmuir was IRE President in 1923. He was Research Scientist for the GE Research Laboratory in Schenectady, NY from 1909-1957and was awarded the Nobel Prize in 1932. In December 1913 he published the results of his studies on the effect of space charge and residual gasses upon thermionic currents in high vacuum. His development of the mercury condensation pump and his studies of tungsten and thoriated tungsten filaments contributed greatly to the success of vacuum tube projection. He invented the gas-filled incandescent tungsten lamp.

Lee DeForest was IRE President in 1930. DeForest, as a young Yale graduate assembled a complete wireless telegraph system including an electrolytic anti-coherer, which he invented and demonstrated on Naval ships as a result of President Theodore Roosevelt’s request. What is often described as the truest little giant in all history was DeForest’s audion or three electrode vacuum tube, which he invented in 1907, which was used as a detector and amplifier. The device was an evacuated (Vacuum) tube with a sealed filament, a platinum plate, and between these a nickel grid. It acted on the principle of a thermal detector, being effective in both wireless telegraphy and telephony, and came to be utilized as a generator and detector. Without DeForest’s invention long distance radio would not have been possible.

After the IRE was formed it remained relatively small, so its headquarters were normally located in New York City at the offices of one of the national officers. In 1928 it moved into the Engineering Societies

Building, until it purchased its own building in 1946 at 1 East 79th Street. For the first 30 years the IRE was one of the smallest of the major engineering societies, but IRE members were the practitioners of the technology of the future and after WW-II electronics became the fastest growing branch of electrical engineering, and membership in the IRE soared past the elder AIEE. In 1947 AIEE had 26,500 members, whereas the IRE had 18,000, but by 1962 AIEE had about half the members, 57,000 to 96,500.

There were many inventions or developments in electronics in Region 1, during the IRE tenure, that have been reported or listed as a milestone by the IEEE History Center which have not been reported above.

1. The dynamic microphone, developed by Curtis and Redding in Boston, MA in 1877.
2. The transmission of commercial music over wire by Cahill in Holyoke, MA in 1881.
3. The Magnetron invented by Hall in Schenectady, NY in 1921. A story circulating in the Raytheon Company, Boston Area, MA is that a magnetron was on test and an engineer who walked past the test area suddenly felt his chocolate bar melt in his pocket, which brought us the development of the microwave oven!
4. Stereo phonography developed at Bell Labs by Keller in 1924.
5. Quartz crystal watch developed in NY, NY in 1925 by numerous technical personnel.
6. Electro-dynamic loudspeaker developed in Schenectady NY by many contributors, in 1925.
7. Differential analyzer developed by Bush in Cambridge, MA in 1927.
8. Coaxial cable developed in 1929 in NY, NY by many contributors.
9. The Electric razor developed by Schick in 1931 in Stamford, CT.
10. The 2-way police radio developed by Gunther and Doyle in Bayonne, NJ, in 1933.
11. IBM mass production of Electric Typewriters by many contributors in Endicott, NY, in 1935.
12. IBM Mark 1 computer development by many contributors in Endicott, NY in 1943.
13. Long playing (LP) records by Goldmark at RCA, Princeton, NJ in 1948.

14. The electronic color TV was developed at RCA, Princeton NJ by Sarnoff in 1949.
15. The junction transistor was developed in 1951by Shockley et al. in NJ.
16. Magnetic core memory was invented, by Wang, at Harvard University in Boston, MA in 1952.
17. The Semi-Automatic Ground Environment (SAGE) system which gathered and processed radar surveillance data, was developed by Lincoln Laboratory in Cambridge, MA in 1952.
18. IBM development of commercial magnetic core memory was accomplished by many contributors in Poughkeepsie, NY in 1954.
19. Electronic music synthesizers were developed by Olsen in NY, NY in 1954.
20. Townes et al. at Bell Laboratory developed the MASER in 1954.
21. The Fortran computer language was developed by Backus in NY, NY in 1956.
22. TELSTAR, the first telecom satellite launch was developed by many contributors in Andover, Maine in 1962.
23. LED's were developed at Syracuse NY by many contributors at GE in 1962.

The AIEE and the IRE grew and prospered side by side, with some Overlapping but the AIEE was oriented toward electric power and industrial applications, whereas the IRE became the electronics society. During and after World War II, electronics was developing rapidly, with radar, computers, television, solid-state electronics and space exploration. Many of these technologies had their early development in Region 1. Electronics became the glamour field for electrical engineering students resulting in stagnation for the AIEE and rapid growth for the IRE. Merger of the two engineering societies had been discussed for many years. In 1922, Alfred Goldsmith, a founder of IRE and A.E. Kennelly a past president of both societies discussed merger, but AIEE had little interest in radio and the attempt failed. By 1945, the AIEE wanted to discuss merger but the IRE had lost interest. By the 50's merger began to gain momentum due to the overlap and duplication of efforts and the attendant costs of operating two institutes. In 1955 a reciprocal membership plan was developed, in which members of one institute could join the other with equivalent grade, without fees and without any substantiating documents. In January 1961 a joint ad-hoc

committee was formed to discuss the merger specifics. A merger plan was developed during 1962 and presented to the membership of both institutes, where it was approved by 87% of the voting members of each. The IEEE was then formed on January 1, 1963. The previous organizations had been "learned societies," concerned solely with the advancement and dissemination of technical knowledge, whereas IEEE assumed the role of a "professional society," concerned with non-technical as well as the technical interests of its members.

The IEEE organization was clearly patterned after the IRE. The AIEE had groups of sections, which they called Geographical Districts, and in 1962 had a total of 15 Districts, and more than 100 Sections. Four of those districts made up what is now Region 1 of IEEE, Number 1 which is NY State, part of number 2 which is Northern NJ, number 3 which is NY City and Long Island, and number 12, the New England area. IRE had 9 Regions and over 100 Sections, which is the organizational approach for IEEE. Regions 1 and 2 of IRE almost exactly map the current IEEE Region 1. Note that New York Long Island and Northern New Jersey which are in Region 1, IEEE were in IRE Region 2.

Region 1 had the first IEEE president, Dr. Ernst Weber. Note that he was also president of IRE in 1959. In 1931 he joined Polytechnic Institute of Brooklyn as a permanent research professor of electrical engineering in charge of graduate study. Under his direction EE enrollment grew from 405 students to 2004. In 1945 he was appointed head of the EE department and Director of The Microwave Research Institute, and in 1957 was appointed Vice President for research.

The 1964 president of IEEE, Clarence H. Linder, was also from Region 1, Schenectady, NY. He was also a President of AIEE in 1960-61. Mr. Linder had an enviable association with GE, starting in 1924. He was vice-president-engineering from 1953-59. In 1960 he was appointed vice-president and group executive-electrical utilities group.

Walter MacAdam from West Lebanon, NH was the 1967 president. He was vice-president of defense communications of AT&T from 1960-68 and VP of engineering for New York Telephone from 1968-73.

Harold Chestnut was the 1973 president. He was a GE engineer in Schenectady and worked on stability, reliability and power systems automation.

Henry Bachman was elected the president in 1987. Bachman's career started in Wheeler Laboratories, where he became president in 1968. When Wheeler merged with Hazeltine Corporation, Greenlawn, NY in 1970, he became a VP of the parent company.

Dr. Emerson Pugh was the 1989 president. He was a research staff member of the IBM T. J. Watson Research Center in Yorktown Heights, NY.

Joel Snyder was the 2001 president. He has his own company, Snyder Associates which does consulting services, in Plainview, NY.

Dr. Michael Adler was the 2003 president. Dr. Adler headed a laboratory of 150 engineering personnel at GE Schenectady, from 1971-2000. The laboratory developed power electronics, control systems, and high-density electronic assemblies.

Dr. Arthur W. Winston was president in 2004. He is Director Emeritus of the Gordon Institute at Tufts University, Medford, MA, where he developed the graduate engineering management school. Dr. Winston was responsible for the development of the Apollo heat shield re-entry temperature measurement system, and the development of a worldwide nuclear test monitoring system.

Dr. Lewis M. Terman was president in 2008. He joined the IBM Research Division in 1961, where he worked on solid-state circuits, semiconductor technology, memory design and technology and digital and analog circuits. He worked on the Research Division staff from 1979-80 and 1991-93. Dr. Terman is president of the IBM Academy of Technology in Somers, NY

Dr. John R. Vig Who is our IEEE 125th Anniversary president. Dr. Vig joined the Electronic Components Laboratory at Fort Monmouth, NJ in 1969, and retired in 2006. He performed and led research in the development of precision clocks, sensors and low-noise amplifiers. He is currently a consultant.

There were a number of electrical and electronics advances that were accomplished in Region 1 since the organization of IEEE, which are listed without inventers since the programs were group initiated:

1. The IBM 360 computer in Binghamton, NY, in 1964
2. Basic computer language in Hanover, NH, in 1964
3. The PDP-8 in Boston, MA in 1965
4. Fiber Optics at Corning, NY in 1966

5. First implantable pacemaker in Clarence, NY in 1967
6. First PC's in Englewood, NJ in 1974
7. Radar development at Rome Air Development Center, and MIT, Lincoln Laboratory from the 1950's to the present

I trust that this presentation has demonstrated that the engineers of Region 1 not only were very active in the development of our IEEE but also developed and invented many of the electrical and electronics marvels we take for granted today.

Richard Ackley
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Mohawk Valley Section Volunteer

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