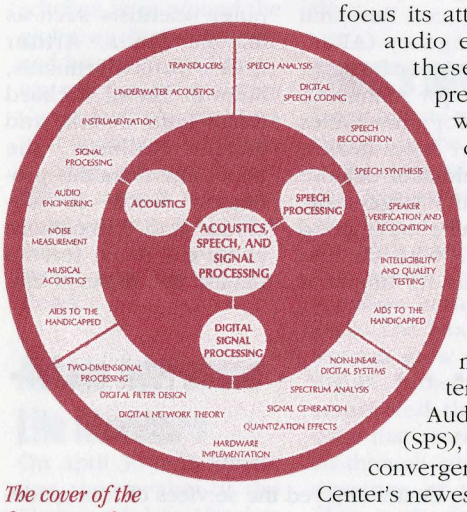
ELECTRICAL ENGINEERING
Center for the History of

NEWSLETTER NO. 42 SUMMER 1996

IEEE

SIGNAL PROCESSING HISTORY

The year 1948 saw its share of landmark events in the technologies of communications. Claude Shannon's mathematical theory of information inaugurated a new era of analysis of communications systems. An early color-TV standard developed by CBS won approval from the FCC, beating out rival systems proposed by RCA and CTI. Magnetic recording was developed to the stage where programs could be aired from tape, and the transistor was officially announced by its inventors at Bell Labs. In the same year, a special subgroup of the Institute of Radio Engineers was organized to focus its attention on the unique problems of audio electronics. Although observers of these events would have been hard pressed to remark on their connection, we recognize in hindsight a significant coincidence. Over the years, the interests of the audio engineers would spread and the power of the techniques used in communications technologies would expand, so that as time passed, the people and the technologies would grow toward each other. This trend reached a climax in 1991 when the IEEE re-christened its former Professional Group on Audio as the Signal Processing Society (SPS), and it is the intriguing story of this convergence that is the subject of the History Center's newest research project.



The cover of the first issue of IEEE Acoustics, Speech, and Signal Processing Magazine, 1984.

Working in cooperation with the SPS, the History Center has begun work on a narrative history of the society and its technologies. The Center's plan is to develop a booklet, consisting of perhaps 50 pages, that covers the highlights of the signal processing story. The booklet will be richly illustrated, and its narrative will be supplemented by biographical sketches, technological descriptions, and historical notes. Plans call for the booklet to be released in 1998, on the occasion of the Society's 50th anniversary.

The Signal Processing Society traces its history back to the formation of the Audio Group of the IRE, the professional society that was to become the IEEE in 1963. Organized in 1948, the Audio Group was the pioneering unit of the IRE's then-new professional group system. Prior to World War II, the IRE did not require structures to support the specialization of its members. Although regional organization had been an important feature of the IRE, coherence in the field of radio engineering, and the common education and methodology of its practitioners, meant that the IRE's members shared enough common technical ground that they could all comfortably cohabitate a single society. After the war, however, the Institute recognized an "amoeba-like multiplication of applications of radio and electronics [that had] led to a divergence of fields of interest so great that the broadcast engineer has in common with the computer engineer mainly only the fundamental phenomena of the electron tube—and even that interest is an indirect association...the audio man and the microwave man are a billion cycles removed from each other." (from an article in the December 1948 issue of the *Proceedings of the IRE* describing the new professional group system) The response was to form a system of professional groups that is the direct predecessor of the IEEE's present system of technical societies.

The first group organized was the Audio Group, established on June 2, 1948, and chartered to focus on "technology of communication at audio frequencies and the audio-frequency portion of the radio systems." Over the years, the purview of the group evolved to include a wider range of technical applications. Known as the Audio and Electroacoustics Group between 1966 and 1973, the Acoustics, Speech, and Signal Processing Group (and then Society) between 1974 and 1990, and the Signal Processing Society thereafter, the group changed frequently to remain close to the interests of its members. These changes in name reflect the transformation of the society from one focused on a specific form of communication technology to one that treats communications at a more general level—a change that is itself reflective of the penetration of signal processing

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CENTER FOR THE HISTORY OF ELECTRICAL ENGINEERING
Issue 42 Summer 1996

Staff Notes

Summer Intern

This year's summer intern is Nina Wormbs. She has a M.Sc. in Engineering Physics from the Royal Institute of Technology in Stockholm, Sweden, and is a graduate student at the Department for the History of Science and Technology at the same Institute.

Nina is just about to finish a book on the Swedish distribution system for radio and TV from the 1920's to the 1990's, which is part of a larger project on Swedish broadcasting history. Her dissertation will treat the history of industrial research laboratories in post war Sweden.

New Book by Aspray

Look on the shelves of your local bookstore for the most recent publication by an IEEE History Center staff member. William Aspray has just co-authored a new popular history of the computer. The book, principally written by Martin Campbell-Kelly, is called *Computer: A History of the Information Machine*. It traces the international history of this all-important technology from the mid-19th century to the present. Although the book emphasizes the business and technical side of the computer's development, it also devotes space to issues of mass interest, including the PC and the Internet. The work is being published by Basic Books (perhaps with the cooperation of IEEE Press) and should be available before the end of the summer. We are expecting a vigorous marketing effort from the publisher, including extensive reviews and wide distribution.

The newsletter reports on the activities of the Center and on new resources and projects in electrical history.
It is published three times each year by the Center for the History of Electrical Engineering.

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NSF History

William Aspray and Andrew Goldstein, working in collaboration with Bernard Williams of R&D Publications, have just published an article in *Vita Mathematica*, a volume published by the Mathematical Association of America. The article, entitled "The Social and Intellectual Shaping of a New Mathematical Discipline: The Role of the National Science Foundation in the Rise of Theoretical Computer Science and Engineering", brings out some salient observations on the NSF's place in promoting the young field of computer science, through both broad analysis and detailed case study.

Many federal agencies sponsored extramural research programs in computing. In particular, the Advanced Research Projects Agency (ARPA, now known as DARPA), was a major source of funding for universities and other laboratories, putting plentiful defense dollars into large-scale, hardware-oriented research. With far less money at its disposal than ARPA, however, the NSF firmly established itself as an important source for support of projects that were markedly mathematical or theoretical in nature soon after it began awarding grants in computing in the mid-1950s. For the Foundation, these grants were a cost-effective way to spread its limited wealth. For the research community, they would prove indispensable in nurturing what was still the undeveloped (and not immediately practical) discipline of computer science. Through profiles of the NSF-supported research of noted computer scientists such as Martin Davis, Arthur Burks, Juris Hartmanis, Manuel Blum, Richard Karp, Lofti Zadeh, and Martin Hellman, the paper illustrates this process at work. It concludes with speculations about the social reasons behind the drive to create the field of computer science.

Vita Mathematica, which contains papers by scholars from around the globe on historiography and history of mathematics, will bring the History Center staff's writing to a new audience. To obtain a copy of the book, please contact MAA Service Center, P.O. Box 90973, Washington DC 20036, tel no. 1 800 331 1MAA.

GRADUATE ASSISTANTS

During the 1995-96 academic year, the Center enjoyed the services of four graduate students of the Rutgers history program. Bringing with them a wealth of research experience and a wide store of knowledge, they provided research assistance and contributed to on-going Center projects and programs.

Jill Anderson completed her second year at the Center. She received a B.A. in history from Carleton College and an M.A. in American history from Vanderbilt University. She recently began her dissertation on relationships between poetry, aesthetics, and masculinity in the early nineteenth century.

Rene Burmeister received a B.A. in math and history from Reed College and an M.A. and in the History of Science and Technology program from the University of Minnesota. She is beginning work on her dissertation on nineteenth century history of medical professionalization.

Stephen Robertson received a B.A.(Hons) in history and a B.A.(Hons) in English from the University of Otago in Dunedin, New Zealand in 1989 and 1990. He is beginning to write his dissertation on the study of sexual violence and the changing understandings of child sexuality in New York City between 1880 and 1950.

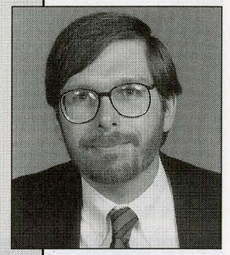
Charles Young received a B.A. in journalism and an M.A. in history from the University of Wisconsin. Currently he is publishing a paper on Hollywood depictions of Korean War POWs and planning a dissertation on Cold War culture.

ASPRAY RESIGNS

On May 31, William Aspray served his last day as Director of the History Center. He has resigned his position here to take over as Director of the Computing Research Association in Washington, D.C.

Dr. Aspray's seven years was the longest tenure as Director in the Center's sixteen year history. In his time here, Dr. Aspray accomplished much: overseeing the relocation of the Center from the IEEE's New York office to Rutgers University, expanding the full-time staff to its present compliment of six, and building a balanced program for the Center, highlighted by the *History of IEEE Technologies* project (formerly *Power and Control*), all while keeping up his own output of historical books and articles.

The IEEE History committee has announced the formation of a search committee to assist in finding a new Director for the Center. The Chair of the Search Committee is Ruth Cowan, of SUNY, Stony Brook.



William Aspray

Abbate Addresses Life Members

On April 30 Jane Abbate was the speaker at the Electro '96 Life Member Luncheon. She spoke on the history of the Internet, beginning with its origins in the Defense Department's ARPANET and describing the network's phenomenal growth and evolution from a military and research tool to a popular medium for communication and entertainment. Along the way the Internet has pioneered new technologies such as packet switching and linked multimedia information as exemplified by the World Wide Web. A lively question-and-answer session after the talk demonstrated the continuing interest and involvement of IEEE Life Members in advanced computer communications.

ENIAC's 50th

Janet Abbate was a participant in the University of Pennsylvania's Historical Symposium, held May 16-18 in honor of the 50th anniversary of the Moore School lectures on computer science. The Moore School lectures grew out of the ENIAC project and disseminated the knowledge that research yielded through intensive discussions of the latest ideas in the field. In the spirit of the Moore School lectures, the May symposium brought together two dozen historians from the United States and Europe to present and debate current issues in the history of computing. Abbate presented a paper entitled "A Tale of Two Networks: Early Data Communications Experiments in England and America," in which she drew on her recent archival study in England to contrast the invention of packet switching computer networks in the two countries.

Lemelson Update

In January of 1996, the History Center began to conduct interviews with pioneers in the field of microelectronics under the auspices of a grant from the Lemelson Center for the Study of Invention and Innovation. The Smithsonian Institution, host to the Lemelson Center, seeks to expand its archival holdings in the history of innovation in microelectronics, and is cooperating with the IEEE History Center to that end.

The overall mission of the Lemelson Center is to elucidate the process of innovation, and in keeping with that goal, the History Center has undertaken interviews aimed at exploring the theme of innovation in this industry. The first series of five interviews is viewed as a pilot project which may lead to an agreement for dozens more.

Drawing upon lists of potential interviewees generated by experts in the field, Center staff members contacted a small number of interview candidates and conducted the interviews between January and June of this year. The interviewees were deliberately chosen to represent the breadth of factors beyond the technical that play into successful innovations. The careers of almost all the interviewees included both engineering and managerial or other non-technical work, so that each interviewee provided a unique perspective on innovation in the microelectronics industry.

For example, one interviewee, Glen Madland, had a successful career in engineering at Motorola before forming his own company, Integrated Circuit Engineering. Located in Phoenix, ICE acted as an industry-wide disseminator of knowledge about cutting-edge microchip technology through seminars, technical publications, and custom product analyses. Another former engineer, Bruce Everitt, moved into venture capitalism in the 1960s, and reflected upon several decades of helping startup firms grow. Former Intel engineer and physics Ph.D. Richard Petritz provided insights both about the

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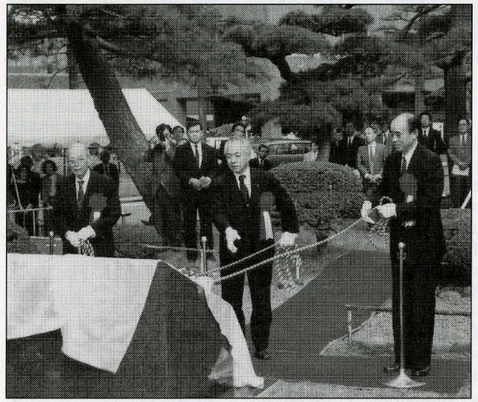
Center interviews five for Lemelson project:

Bruce Everitt
Federico Faggin
Steward Flashen
Glen Madland
Richard Petritz

Center Activities

YAGI-UDA IS MILESTONE

An antenna that radiates power in all directions equally may sometimes be appropriate, but in the vast majority of cases it is preferable to confine the radiated waves to a particular plane or a particular direction. Directional antennas do this, and one of the most important types is the Yagi-Uda antenna. It combines a single driven-antenna with an array of passive elements, called directors, that radiate after receiving power from adjacent elements (forming what is called a closely-coupled parasitic array). This design makes it possible to achieve high directivity with a compact antenna. The Yagi-Uda antenna has been extremely important in numerous applications, such as radar, television, and short-wave radio, involving the higher-frequency ranges (especially the range between 100 and 1000 megahertz).



Dedication ceremony for the Yagi-Uda milestone

Hidetsugu Yagi, born in 1886, received an engineering degree from Tokyo Imperial University and then continued his studies in Germany, England, and the United States. Shortly after World War I, Yagi initiated a radio research program at Tohoku University in Miyaga, Japan, and in the early 1920s one of his advanced students was Shintaro Uda. In 1926 Yagi and Uda jointly published a paper describing the new antenna. The work came to international attention mainly through an English-language paper that Yagi published in *Proceedings of the IRE* in 1928. (The Institute of Radio Engineers (IRE) joined with the American Institute of Electrical Engineers in 1963 to form the IEEE.) This invention came at a crucial time, when new tubes permitted transmissions at higher frequencies.

On 17 June 1995 at Tokohu University, the IEEE Tokyo Section held the dedication ceremony for the new IEEE Electrical Engineering Milestone. The plaque citation reads as follows:

DIRECTIVE SHORT-WAVE ANTENNA

In these laboratories, beginning in 1924, Professor Hidetsugu Yagi and his assistant, Shintaro Uda, designed and constructed a sensitive and highly-directional antenna using closely-coupled parasitic elements. The antenna, which is effective in the higher-frequency ranges, has been important for radar, television, and amateur radio.

LEMELSON UPDATE continued from page 3

management of large research and development projects and the operation of the startup firms that he helped build, such as MOSTECH. Federico Faggin, who did pioneering work in microprocessors before moving into management, discussed the problems of fostering innovation in the context of different corporations, changing economics, and rapidly advancing scientific knowledge. Steward Flashen gained extensive experience in engineering and the management of engineering R&D at Bell Labs, Motorola, and ITT before becoming a partner in a management consulting firm oriented toward high technology investments. Not incidentally, several of these interviewees are senior members or fellows of the IEEE.

The interviews gathered by this project will become a part of the History Center's oral history collection, as well as the oral history holdings of the archive of the National Museum of American History in Washington, D.C. The History Center staff is now preparing a proposal to conduct up to 50 more interviews in the history of innovation in microelectronics in the United States.

The last newsletter reported that the Center was organizing a summer conference on the history of computing to be held 13 to 16 June 1996 in Calgary, Alberta. Because of the small number of registrants (due partly to the expense of getting to Calgary and partly to the competition of other computer-history gatherings), it was decided to postpone the conference for one year and to move it to the East Coast (within automobile-range for many people).

The plan is to hold the conference at William & Mary College in Williamsburg, Virginia on 13, 14, and 15 June 1997 (Friday through Sunday). Besides the beautiful college setting, the new location features Colonial Williamsburg, Busch Gardens, James River plantations, and Yorktown. The College has dorm rooms available (including small apartments in a graduate complex), and we're asking the College to allow us to use the rooms from Wednesday 11 June to Monday 16 June so that people will be able to take some time before and after the conference to see the sights. The first day of the conference will be a series of invited lectures by distinguished historians of computing from Europe and North America; on the second day, attendees will give 20- to 30-minute talks; and the third day will be a workshop for engineers and computer scientists on historical methods taught by leading historians and archivists. Registration and other information will be contained in the next newsletter.

FELLOWSHIP AWARDED

The 1996-97 IEEE Fellowship in Electrical History has been awarded to two co-winners, Christophe Lécuyer, and Andrew Robertson.

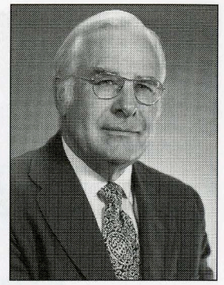
Lécuyer, completing his dissertation from Stanford, will continue his studies of the military, electronics manufacturing and the rise of Silicon Valley between the years 1948 and 1972. Lécuyer's ambitious plan is to move beyond the tradition of studies demonstrating how the military's influence shaped the structure of the electronics industry and the design of radio and semiconductor devices, and look instead at the role played by the military in the development of new production technologies and forms of work organization in the tube and semiconductor industries.

Robertson, who is pursuing a Ph.D. from Harvard's History of Science program, is studying the transfer of automatic control technology between the United States and Japan in the period 1920-1970. Contending that industrialists, bureaucrats, and academics interpreted control technology differently in the two societies—in America, social scientists and control engineers produced a cybernetic interpretation of the self that defined the individual in terms of a complicated feedback system existing in an information stream, while in Japan, academics and bureaucrats viewed control technology as the material and technical bases for national growth and prosperity—Robertson uses control technology as a vehicle for understanding the material and sociocultural transformations necessary to move technologies between societies.

We expect both these research projects to yield provocative results that should stimulate considerable debate about a wide range of issues. The two co-winners will split the $15,000 fellowship on a prorated basis. The Fellowship is made possible by the generous support of the IEEE Life Member Fund.

See pg. 12 for information on the '97-'98 Fellowship.

WRIGHT EXHIBITS



Charlie Wright

Charles Wright, long time History Committee member and friend of the Center, has been hard at work, introducing historical content to various IEEE events. In 1994, Wright arranged for the display of an antique high-voltage oil break switch—a 1903 General Electric model, rated 60,000 volts, 100 amps—at the IEEE Industrial Application Society annual meeting held in Denver. At the 1995 IEEE Petroleum and Chemical Industry Technical Conference (PCIC), Wright again arranged for the display of the oil switch, along with an Elihu Thomson watt-hour meter. The display attracted such favorable attention that the PCIC technical committee has planned to expand the historical artifacts display at its 1996 meeting in Philadelphia. Wright's efforts have earned him praise from the crowds at these events and the appreciation of the staff at the Center as well.

RADAR RESEARCH

In June, the Center hosted David Winkler, a historian with the U.S. Army Construction Engineering Laboratory in Champaign, Illinois. Winkler came to the Center seeking assistance with study of Air and Space Defense sites in the United States during the Cold War. The study, funded under the Department of Defense Legacy program and due for publication in 1997, will provide cultural resource managers (usually associated with State Historical Preservation Offices) a historical context for various radar stations, command and control centers and other aircraft or missile tracking facilities. The study will have a site listing section, a nomenclature listing section, and a historical overview section. Winkler is continuing his research and is particularly interested in obtaining additional specifications on the ground-based AN/FPS series of search and height finding radars. For additional information, please contact David Winkler at (301) 984-0629 or dw2049@american.edu.

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In 1987 Albert Abramson published *The History of Television, 1880 to 1941* (McFarland & Company), an exceptionally comprehensive and well-documented history of television technology. This biography of Zworykin is also exceptionally well-documented: Abramson draws on a wide range of published and unpublished documents and on interviews with many television pioneers. (Abramson received material on Zworykin, under the Freedom of Information Act, from six government agencies.) The bulk of the book is a narrative account of Zworykin's life, which relates his work to that done by the many other contributors to the development of television. In the 93 pages of notes, Abramson provides much additional information, careful discussion of sources, and judicious evaluation of historical writings about Zworykin.

BENNETT, STUART. *A History of Control Engineering 1930-1955.* London: Peter Peregrinus on behalf of the Institution of Electrical Engineers, 1993. xi + 250 pp.

As in his earlier *A History of Control Engineering 1800-1930* (Peter Peregrinus, 1979), Stuart Bennett provides a detailed technical history, solidly based on published and unpublished primary sources, that encompasses many different types of control systems. The first chapter, "Control technology in the 1930s", sets the stage. The next chapters consider in detail three areas: process control, negative feedback amplifiers, and servomechanisms. Bennett argues that there were problems common to these areas but that "the lack of a common language with which to describe the problems" hindered "recognition of this commonality and the development of appropriate abstractions". There follows three chapters on World War II, when numerous engineers, with different backgrounds, collaborated in developing highly complex automatic-control systems, such as for anti-aircraft fire control. The wartime work provided a common language and body of knowledge (principally frequency-response methods), elaborated in publications of the postwar decade. These publica-

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tions are covered in the final chapter, "The classical years: 1945-1955" (so-called because in the 1960s the earlier work was dubbed "classical control theory" to distinguish it from "modern control theory" using time-domain approaches).

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Packet Communication is the first in a series of reprints of historically important computing documents called Computer Classics Revisited. The book includes Metcalfe's 1973 doctoral dissertation, *Packet Communication*; two ARPANET RFCs (requests for comments) from the early 1970s; and a brief "Retrospective" in which Metcalfe reviews his earlier work. Metcalfe was an important pioneer in computer networking: he designed the Ethernet local-area network system while at Xerox PARC and contributed to the development of the TCP/IP-based Internet. His "Retrospective" recounts how he became involved in networking as part of the ARPANET community and got the idea for Ethernet after studying the University of Hawaii's Alohanet packet radio network. For his contributions to networking Metcalfe was awarded the IEEE Alexander Graham Bell Medal in 1988 and the IEEE Medal of Honor in 1996.

Metcalfe's dissertation covers three main areas: store-and-forward packet communication as exemplified by the ARPANET (Chapters 2 and 3), broadcast packet communication as exemplified by Alohanet (Chapters 4 and 5), and interprocess communication (Chapter 6). Chapter 5, in which Metcalfe analyzes broadcast packet communication, may be the most valuable to the historian interested in Metcalfe's original contributions to the field. It contains a key insight—namely, that controlling retransmission in response to traffic loads can radically improve the throughput of such systems—which later became important to the success of Ethernet. Chapter 6 draws on David Walden's RFC #62, "A System for Interprocess Communication in a Resource Sharing Computer Network," reprinted in this volume. Walden's and Metcalfe's ideas shed light on alternative approaches to those adopted in the ARPANET host protocols. The final section of the book is Metcalfe's RFC #89, "Some Historic Moments in Networking," which provides an interesting glimpse of how early network users had to work around computer system incompatibilities.

OKAMURA, SOGO, editor. *History of Electron Tubes.* Tokyo: Ohmsha, 1994. Distributed in Europe and North America by IOS Press, Amsterdam, Oxford, and Burke, VA. viii + 233 pp.

This book is the translation of the first four chapters of a 13-chapter Japanese work, having the same title, published in 1987. The four chapters—"Birth of electron tube", "Development of vacuum tube industry", "Receiving tubes", and "Transmitting tubes"—follow developments from the turn of the century to the 1980s and are abundantly illustrated with drawings, photographs, and charts. Sources of information are not given. The book takes an international perspective, yet all of the chapters give attention to developments within Japan, thus providing much information not otherwise available in English.

The Newsletter's *"Bibliography" section was prepared with the assistance of Prof. Thomas J. Higgins of the University of Wisconsin–Madison.*

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Photo courtesy of the Smithsonian Institution

Marconi receiving an honorary degree at Columbia University in 1922.

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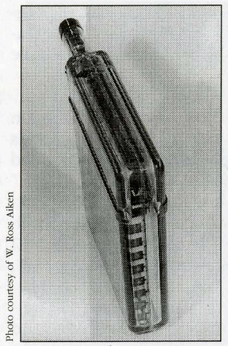

Photo courtesy of W. Ross Aiken

A 14" Aiken Thintube, a flat CRT. The electron gun is protruding from one corner.

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And Don't Miss ...

A number of other interesting historical writings have recently been completed:

• Antonio Botelho has just finished a doctoral dissertation entitled "Professionals Against the State: French Electronics Policy in Historical Perspective." And at the 1995 Business History Conference, Pierre Mounier-Kuhn gave a paper entitled "French Computer Manufacturers and their US Partners, 1950-1970"

continued on page 8

Bibliography

• The Cable & Wireless company of England has released a CD-ROM and accompanying booklet entitled "A History of Cable & Wireless"

• Philip L. Cantelon, whose article on microwave technology appears in this month's bibliography, wrote a book entitled "The History of MCI, The Early Years." Although the book is not open for unlimited distribution, copies might be made available by contacting Adam L. Gruen, MCI Corporate Archives, 1133 19th St. NW, Washington DC 20036, tel. 202 736-6290.

• The Chiba Museum of Science and Industry in Japan has issued "Report on the History of Industry in Chiba Prefecture."

• E.J. Craig has published his own "EE at Union, 1895-1995", a celebration of the centenary of one of the early electrical engineering programs. Similarly, Walter Turner has prepared an unpublished work entitled "A History of Electrical Engineering Education at the University of Maine, 1894-1994."

• The IEE, which recently organized a celebration of the 100th anniversary of radio, has issued the proceedings from the conference. Ask for conference publication 411.

• The NASA History Office has published "Beyond the Ionosphere: The Development of Satellite Communications. Vols. 1-2", the proceedings of a conference held in Washington DC, October 17-18, 1995. Contact NASA History Office, (202) 358-0384, rlaunius@codei.hq.nasa.gov.

• David Singmaster has released "Chronology of Computing" on computer disk. Contact David Singmaster, School of Computing, Information Systems and Mathematics, South Bank University, London, SE1 0AA, UK, ZINGMAST@VAX.SBU.AC.UK.

• Yuzo Takahashi delivered a paper at the 1995 meeting of the Society for the History of Technology entitled "Advent of the Television Receiver Industry in Japan: Roles Played by the Tinkers, the Components Manufacturers, and the Kits."

• Kuniaki Tanaka is the lead author on a volume entitled "The Catalogue of Electron Tubes of Department of Electrical and Electronics Engineering [of Chiba University]."

Radio Monographs

A series of monographs on special topics in the history of radio are available from the Pittsburgh Antique Radio Society.

• *The U.S. Patents of John H. Hammond*, Jr by David W. Kraeuter (1994)

• *The U.S. Patents of Reginald A. Fessenden* by David W. Kraeuter (1990)

• *A New Bibliography of Reginald A. Fessenden* by David W. Kraeuter (1993)

• *A Bibliography of Frank Conrad* by David W. Kraeuter (2nd ed. 1990)

• *An Interview with Harold Beverage* by Richard Brewster (1995)

• *Radio and Television Reminiscences (columns from the "Pittsburgh Oscillator")* by Raymond M. Bell (1995)

The monographs cost $5 each. For more information, contact David W. Kraeuter, Pittsburgh Antique Radio Society, Inc., 506 E. Wheeling Street, Washington, PA 15301.

Things to See and Do

SWEDISH RADIO

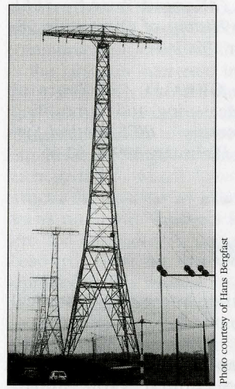


Photo courtesy of Hans Bergfast

The multiple-tuned antenna at Grimeton

In 1922, construction began in Grimeton, Sweden on a new radio station to establish superior communication links with the United States. At the heart of the Grimeton station was an Alexanderson alternator, the transmitter technology invented by Sweden's own Ernst F W Alexanderson in 1910. With the Alexanderson alternator, manufactured by General Electric and sold by RCA, the Grimeton station was able to begin transatlantic transmissions in 1924. At the time of the official dedication, held in July 1925, King Gustaf V declared to Calvin Coolidge that the station would greatly strengthen the cultural and commercial bonds between Sweden and the United States.

Seventy years later, the Grimeton station is still operational. Using what is claimed to be the last functioning Alexanderson alternator, the station last year broadcast a message to the IEE's "100 years of radio" conference held in London. In an age when satellite links make intercontinental communication routine, the alternator provides a stirring reminder of how far transmission technology has come.

The station facility is in impressive spectacle. The multiple-tuned antenna, carried by six 125 meter masts, each with a 46 meter cross beam carrying the twelve wires that feed the six verticals at the top of the mast, is still preserved. The masts each weigh approximately 130 tons and the twelve antenna wires have a total length of 2,200 meters. All the buildings at the radio station are preserved, including a village for the workers that was built nearby.

Can the last surviving Alexanderson alternator be preserved for future generations? The County Council of Halland is working to have the station listed as a Cultural Heritage, thereby giving it legal protection. But protected or not, conservation work is needed to prevent the site from deteriorating. The present owner of the station, Telia Mobitel AB, is interested in developing the site as a science museum, but intensive fundraising is required to realize these ambitions. For more information, please contact Hans Bergfast, Länsstyrelsen Hallands län, Kulturmiljöenheten, S-301 86 Halmstad, Sweden, tel. no. 46 35 13 20 00.

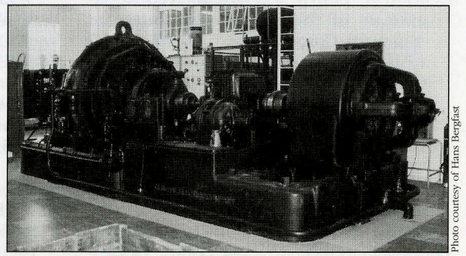


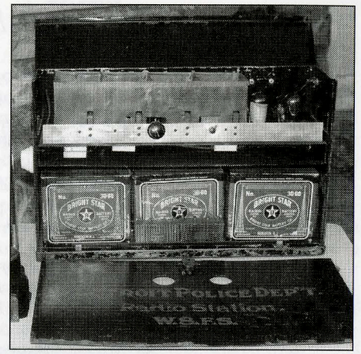
Photo courtesy of Hans Bergfast

Grimeton's Alexanderson alternator

RAYTHEON ARCHIVES

It's hard to imagine, but Raytheon, the $12 billion dollar electronics and weapons giant with over 75,000 employees, was once a small company desperate for a product to keep its head above water. Raytheon traces its roots back to Spencer Thermostat Company, a small company founded in 1921 whose sole product was the Klixon, a bimetallic disk that snapped when its temperature was raised or lowered. When the company's attempt to venture into compressorless refrigerators met with failure, the scramble began to find a different product that they could sell. This was the mid 1920s, when the jazz-age radio boom was still in full swing and household electrification was growing common across America. Seeing an opportunity, Raytheon inventor C.G. Smith developed a tube that allowed owners of battery-driven radios to retrofit their sets to draw power from house current. The "B tube"—so called because it allowed the elimination of the B battery from the radio set—was a great success, and the name "Raytheon" became a standard in the radio tube business.

During the 1930s, however, the company's growth began to flatten and the search was on once again for something new. The answer came from the mechanical ingenuity of Percy Spencer, the younger brother of the company's founder. Percy found a way, at the opening of World War II, to break through a crippling production bottleneck that limited output of microwave magnetrons, the British invention that was the heart of most radar systems. Spencer replaced the time-consuming process by which the magnetrons were precision machined out of solid metal blocks with a punch-press process that allowed magnetrons to be built up out of laminated layers. Raytheon went on to manufacture close to 80% of the magnetrons used by the allies during World War II. The experience solidified Raytheon's position as a military contractor and positioned it for a wave of technological innovations that helped secure its future stability. Among these were the first microwave oven, developed in 1946 and offered for sale to restaurants, trains, and ocean liners the following year.



A 1928 receiver with its enormous "B" batteries. The Raytheon "B" tube helped eliminate these behemoths.

The early treasures of the Raytheon Company are ably preserved in an archive maintained by one of the firm's most senior engineers, Norman B. Krim. With ten display tables covered by artifacts, documents and photographs, numerous file cabinets of company records and memorabilia, drawers of landmark tubes, and a library of books and videos, the archive is an unmatched source for information about the history of this important company. Some of the most exciting items in the 1,100 sq. ft. facility include documents signed by Vannevar Bush, one of Raytheon's founders; early subminiature vacuum tubes, which sustained the company in the late 1930s when they were used for hearing aids and then found wartime application in proximity fuses; files on Raytheon's pioneering production line of junction transistors; the world's first experimental microwave oven, which one of Raytheon's founders used in his home for over thirty years; and other early magnetron hardware.

The archive's mission is to acquaint current employees, retirees, and research scholars with the early history of Raytheon. Krim has contributed to this goal by maintaining the archive for visitors and using its resources to assist with the production of several video documentaries on Raytheon technology and its history. At the end of the summer, he will move the archive from its long-time home in Waltham, Massachusetts to a new facility in Lexington. For more information, contact Norman B. Krim, Raytheon Archives, 20 Seyon Street, Waltham, MA 02254.

ELECTRIC METERS

On February 26, 1996 the Georgia Power Company's Arkwright Museum of Electric Faces, Places and Spaces unveiled its latest exhibit, "Measuring the Magic: The History of Electric Meters." The display traces the development of electric meters from the earliest Edison meter through the latest in digital measuring devices. The twenty-five meters on display are representative of the more than one hundred years of their history. Artifacts include not only watt-hour meters, but materials related to meter reading, testing, repairing, and safety. This exhibit is the collaborative effort of Kevin Rusnak, Georgia Institute of Technology graduate student on the history of technology; Margaret Calhoon, archivist-curator and historian for the Georgia Power Company Land Department; J.D. Huddleston, III, Georgia Power engineer and owner of one of the most extensive meter collections in the country; and Tommy Smith of the Georgia Power Central Meter Shop. "Measuring the Magic" will be on display through 1996.

The Arkwright Museum was instituted in 1993 for the purpose of informing employees and visitors on the history of the Georgia Power Company and the development of electric energy and the power industry. The museum is located in the Connector Building Lobby of the Corporate Headquarters, 333 Piedmont Ave., Atlanta, Georgia.

TESLA ARCHIVES

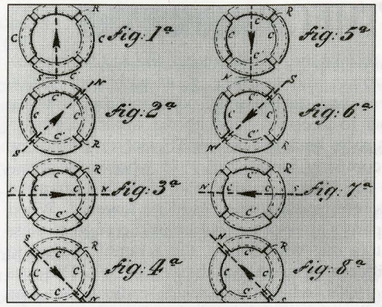
A unique opportunity for museums and repositories of electrical history has recently emerged. The firm Boyle and Anderson of Denver, Colorado, which owns an archive on Nikola Tesla believed to be the largest collection in private ownership in the world, has opened their collection for bid acquisition.

The archive is in three parts:

• Twenty-four lots of Nikola Tesla correspondence, manuscripts, and documents, ranging in date from February 21, 1894 through October 31, 1942. Some of the most significant and colorful items in his career are represented, including a letter in French to a woman admirer, and a 46-line poem entirely in his own hand, "Fragments of Olympian Gossip", humorously 'observing' a number of past scientists and philosophers such as Archimedes, Fermat, Newton, and Kelvin.

• Sixty bills and receipts for supplies provided to Tesla from various vendors, addressed to both his Houston Street laboratory in New York City and his experimental station in Colorado Springs.

• A collection of more than 750 photographs of and about Nikola Tesla and his work. The images concern Tesla's life and career, laboratories, apparatus, celebrations, and commemorative events following his death. Captioning and supplemental historical notes are included. The photos are contained in six 28 cm by 28 cm binders, plus one additional binder that measures 33 cm by 38 cm. (all having transparent envelope-pockets) weighing just over 18 kilograms and occupying 76 cm. of shelf space.



Nikola Tesla's drawings of his induction motor's rotating magnetic field

Asking price for the archive is $17,000 and bids will be accepted in writing up to December 15, 1996. Appointments are encouraged for examination of the material. For more information, contact Leland Anderson, Boyle & Anderson, 2525 South Meade St., Denver, CO 80219.

POCKET CALCULATORS

For the engineer, few pieces of electronic equipment can match the electronic calculator as a symbol of technological change. Seemingly overnight, the calculator swept through labs and offices in the early 1970s, rapidly replacing the engineer's long-trusted ally, the slide rule. Even for the public-at-large, the calculator made an impressive impact. It was one of the earliest direct exposures to digital electronics, and, in retrospect, can be seen as a prelude to the age of the personal computer. Indeed, the famous story is told of how Steven Wozniak sold his Hewlett-Packard programmable calculator to scrape together enough money to launch Apple Computers. More than just a symbol, however, the calculator was a breeding ground for technological change. The first widespread non-military use of ICs was for calculators. And, of course, the motivation for the Intel 4004, the world's first microprocessor, was a desktop calculator.

The legacy of this important device is celebrated and preserved by the International Association of Calculator Collectors. With members in over fourteen countries, the Association trades information on the history of the calculator. The group explores developments in the calculator's technical and commercial history, often looking beyond strict technical history to consider matters such as the design of the case—the point of human interface—to understand the path of calculator history. In a quarterly journal, articles on the early history of calculators, spotlights on key manufacturers, columns on pricing trends and unique calculator models share space with listings of opportunities to acquire collectable pieces. For more information, contact Guy Ball, mrcalc001@aol.com, (postal address IACC, P.O. Box 345, Tustin CA 92681), http://www.bath.ac.uk/~masres/calcs.html

"Interesting result attained, with aid of Roentgen rays, by a first-floor lodger when photographing his sitting room." An 1896 illustration from Punch.

X-RAY EXHIBIT

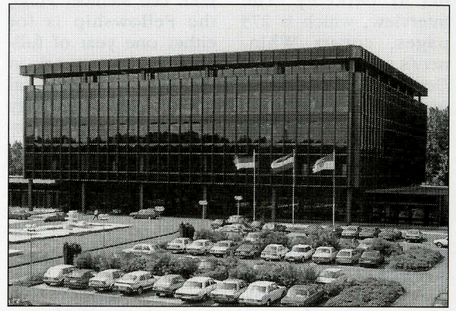
The Bakken Library and Museum in Minneapolis is celebrating the centenary of X-rays with an exhibit that opened March 23. Instruments and books from the Bakken's collection on display include induction coils, control panels, X-ray tubes, X-rays from the early part of this century, and an Adrian Shoe X-ray Fitter (ca. 1950s), used to X-ray the proper fit of shoes. Books, trade catalogues, and articles from the early days of X-ray, including Roentgen's "Eine neue Art von Srahlen" are also on view. In addition, a poster exhibit from the Radiology Centennial Society, Inc. covers the wall of one gallery. It features a detailed timeline that carefully traces the history of X-rays from 1895 to 1995 in the fields of diagnostic medicine and cancer treatment. For more information, please contact Elizabeth Ihrig, the Bakken, 3537 Zenith Ave. So., Minneapolis, MN 55416, tel no. (612) 927-6508.

GERMAN IT MUSEUM

In October, a new experiment in information technology heritage will be launched in Paderborn Germany. The Heinz Nixdorf MuseumsForum (HNF), named after one of the pioneers of the German computer industry, is scheduled to open its doors. More than four years in the planning, the HNF will employ a unique organizational structure to attempt to present and explain the dynamic changes associated with information technology.

The new idea is a two-track approach. The HNF will have a traditional museum, with a 7,000 sq. meter exhibition space housing more than 1000 exhibits relating to calculating machines and computers, writing and printing, accountancy and office automation. The classical museum approach will be blended with the use of advanced media, such as interactive computer stations and virtual reality tours, to produce a multimedia experience. Decidedly international in scope, the displays will include material on such topics as information technology pioneers and the role of Silicon Valley. There will also be a computer history library and archive for researchers to use.

In addition to the convention display space, however, the HNF will feature the "Paderborn Podium", a forum for discussing the opportunities and risks of technological development. With the goal of making a major contribution to a future for the information society which is humane and geared to ethical values, the HNF forum will be a first-rate convention center, boasting state-of-the-art equipment such as large screens, interpreting, video recording, and trained staff to aid with planned events. The HNF forum rounds out the institution's commitment to focusing on the social implications and cultural meaning of information technology.



Artist's representation of the Heinz Nixdorf Museum in Paderborn

For more information, contact the Directors Norbert Ryska and Theodor Rode, HNF Heinz Nixdorf MuseumsForum GmbH, Fürstenalle 7, D-33102 Paderborn, German, tel. no. ++49 5251 3066 00, http://www.hnf.de.

SIGNAL PROCESS HISTORY
continued from page 1

techniques into more and more applications. The history that the Center will write will be an intriguing web of institutional and technical history, revealing much about how the engineering profession cultivated the emerging technologies of signal processing. Although research has just begun, the Center expects it will discover that the story of how the audio engineers grew to identify themselves as signal processing specialists should be a telling example of technical change and professional identity-making.

In addition to the booklet, the Signal Processing History Project includes an oral-history component. Recognizing the value and appeal of capturing technological pioneers in conversation about their own contributions, the History Center will conduct ten oral history interviews with leading figures in signal processing technologies. These interviews will be edited and deposited in the archives of the Signal Processing Society.

The Signal Processing History Project represents an opportunity for Center historians to gain a deeper understanding of the development of signal processing technologies. This research is expected in turn to enrich the treatment of these technologies in the Center's principal project, the three volume history of electrical engineering called *History of IEEE Technologies* (HIT, formerly called *Power and Control*), an opportunity that is greatly welcomed by the HIT authors. In today's information age, when the field of signal processing has grown to the point where its techniques can be found deeply imbedded in a wide variety of electrical technologies, this heightened awareness of signal processing will contribute meaningful insight to many aspects of that important project.

The Signal Processing Society has organized an ad hoc history committee for the purpose of guiding the History Center in its work. The committee is chaired by David Munson (University of Illinois). Its other members are Jonathan Allen (MIT), Dan Dudgeon (MIT Lincoln Laboratory), Tariq Durrani (University of Strathclyde, Scotland), Don Johnson (Rice University), and H. Joel Trussell (North Carolina State University). Staff support is supplied by Mercy Kowalczyk, the Executive Director for the Signal Processing Society. It is through the Society's board of governors that special funding was made available to the History Center to undertake this work. The Society's grant, $35,000 spread over 1996 and 1997, is provided in addition to the generous endowment support that the History Center has received from the Signal Processing Society in the past. The Society is now elevated to the level of Senior Partner of the History Center, the first of the IEEE Societies to achieve this status. The Center is anticipating that the Signal Processing Society's leadership will galvanize other IEEE societies to join in to what will ultimately become an Institute-wide historical program.

Whinnery Oral History

John R. Whinnery, well known for his innovative work in microwaves and optoelectronics, has recently completed recording an extensive oral history with the regional history office of the Bancroft Library of the University of California at Berkeley. The interview, which is 273 pages, covers Whinnery's youth, his work at General Electric, Hughes Aircraft, and Berkeley, where he was Dean of the College of Engineering between 1959 and 1963. Also discussed is his collaborations with Simon Ramo; service on governmental, scientific, and industry boards; and the NASA Apollo program, among other topics.

The Whinnery volume is available for study at the Bancroft Library and UCLA's Department of Special Collections. Copies of the transcript, bound and indexed, are available from the library for $69 (plus $4 S&H). For more information, contact Regional History Office, 486 Library, University of California, Berkeley CA 94720, tel. no. 510 642-7395.

Fellowship Available

Applications are currently being accepted for the 1997-8 Fellowship in Electrical History. Funded by a grant from the IEEE Life Member Fund, the Fellowship is for either one year of full-time graduate work in the history of electrical science and technology at a college or university of recognized standing, or for up to one year of independent research for a recent Ph.D. graduate in the same field. The stipend is $15,000.

The Fellowship Committee evaluates applicants on the basis of a complete description of the proposed research, college transcripts, letters of recommendation, and additional information supplied on the application form. Students with undergraduate degrees in engineering or the sciences as well as those having degrees in the humanities are invited to apply. The deadline for receipt of applications is 1 February 1997, and three copies of the entire application package must accompany the original. Applications forms are available from the Center.

Electron's 100th

A correspondent writes to remind us that 1997 will mark the 100th anniversary of J.J. Thomson's discovery of the electron. He asks if any group is planning to recognize this historic milestone with a formal ceremony or event. His own ideas for a commemoration include an international conference, publications, exhibits, issuing a postage stamp, radio and television programs, and establishing an award in Thomson's name to recognize the best research and application of the electron. People interested in helping to organize one of these projects, or some other sort of commemorative measure, are invited to contact M.B.S. Char, 27 11th "A" Cross Road, Parsy Layout, S.P. Extension, Bangalore-560 003, India.

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