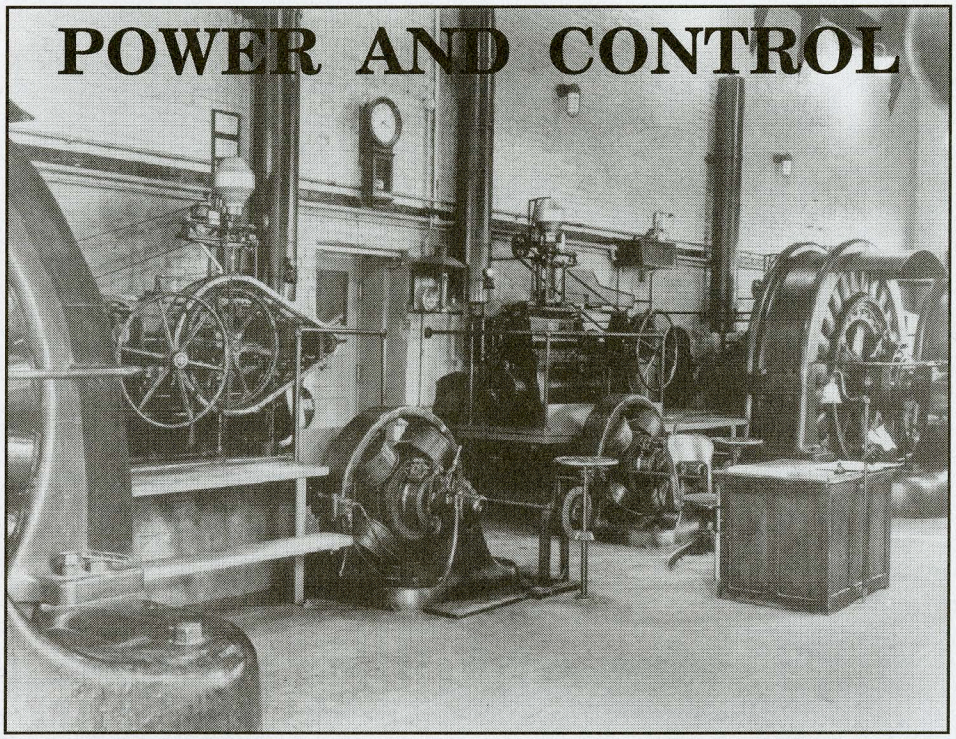
Center for the History of Electrical Engineering

Newsletter No. 31 Fall 1992



Power House No. 1 of the Folsom, CA hydroelectric plant, 1895.

THE CENTER LAUNCHES A MAJOR RESEARCH AND OUTREACH PROGRAM

In the last several years Center staff have talked with a great many engineers, and over and over again these people have mentioned the need for a survey history of electrical, electronics, and computer engineering from its beginnings in the mid 19th century to the present. We have been equally cognizant of another need: because virtually all forms of electrical technology have undergone spectacular development in the last half century and because this development has received relatively little attention from historians, it is imperative to preserve the remembrances and personal papers of the engineers who have lived through this period. The Center is pleased to announce that with the support of the IEEE Foundation we are beginning a major project directed toward both of these needs.

Beginning in early 1993 we will be researching and writing a comprehensive history of electrical, electronic, and computer technology. Our objective is to explain how engineering science and its main applications developed in their scientific, economic, and social contexts, and how these contexts were affected by electrical technology. This is to say, the book will be both technical and contextual history. As is appropriate to the subject matter, the book will take an international perspective and two-thirds of it will deal with events since 1920. Our intended audience is, first and foremost, the engineering community, but the book will be accessible to all educated readers.

The story will be told chronologically. This organization we judge preferable to one that considers in turn the main applications for two reasons. First, at a particular point in time many applications are shaped by a common social context, such as the rapid urbanization in the United States at the turn of the century, or the exigencies of World War II, or the space race of the 1960s. Second, all applications draw on a shared state-of-the-art and a shared state-of-the-profession, including such things as contemporary EE theory, the establishment of industrial standards, the development of instruments for test and measurement, the availability of off-the-shelf components, and the EE education provided by colleges and universities. A working table-of-contents is shown on pages 4 and 9.

All of the Center staff will be involved in the three-year project, which will be directed by Research Historian Frederik Nebeker. He and Research Historian Loren Butler, who will join the staff in early 1993 (see Staff Notes), will be the principal authors. The Center's Director, William Aspray, will be continually involved in the planning and execution of the project, and the Center's Curator, Postdoctoral Researcher, and four graduate students will also contribute. We will take advantage of the excellent connections of the Center with the engineering and historical communities in this country, Europe, and Japan to call upon the expertise of engineers and historians both for assistance in the research and for critique of the draft chapters. Of particular value will be the advice given by the Technical Activities Historical Liaison Committee (see page 5).

The primary literature, the historical literature, and available archival materials will be the main sources for many of the chapters. For the chapters dealing with events since 1920, oral-history interviews with leading engineers—to be conducted as part of the project—will be a principal source of information and insight. We will ask to examine personal papers and company records; when we encounter particularly valuable papers, we will work to arrange for their permanent preservation.

A few of the themes that the book will develop are the following: the drawing together of engineering practice and scientific research; the rise of collaborative engineering; market-pull and invention-push as forces for new technology; the importance of industrial standards; the synergy of new technologies; and the

(continued on page 4)

STAFF NOTES

Graduate Students

The Center is benefitting this year from the part-time service of four Rutgers graduate students of history: Eric Boyles, Jill Cooper, Colleen O'Neill, and Christine Skwiot. They each bring a unique background and perspective to the historical research they do.

- Boyles holds a bachelors degree in the history of science from the University of Wisconsin at Madison. He worked for the Center as a graduate assistant in 1991-92 and has written on the techniques and ideology of 19th century maintenance engineers and repair technicians.

- Cooper graduated from Bucknell University in 1990. At Rutgers, she is doing classwork on the societal context of biomedical technology.

- O'Neill holds a B.A. degree in government from Pomona College and an M.A. degree in american history from New Mexico State University. She is an advanced student in the Rutgers History Department and will soon begin writing her dissertation on women and mining in America's Southwest.

- Skwiot received a B.A. degree in history and political science from the University of Michigan at Ann Arbor and an M.A. degree from the Hagley program in history of technology at the University of Delaware. She is currently planning a dissertation that will focus on cultural history. ■

Staff Update

We receive many inquiries from IEEE members about the present activities of former key employees of the Center. All of our past staff have continued their productive careers:

Robert Friedel was Director of the Center from its inception in 1980 until 1984. He is now a professor of history at the University of Maryland at College Park, where he is working on a history of the zipper.

Ronald Kline, director of the Center from 1984 to 1987, is now teaching in both the history and philosophy of science and technology program and the college of engineering at Cornell University. He recently completed a biography of Charles Proteus Steinmetz (see bibliography, page 6). He is president of the IEEE Society on Social Implications of Technology and won a 1992 Excel award for best editorial or column with his column "'Engineer of Death' or 'Winning with Technology'", published in the summer 1991 issue of the society's magazine "Technology and Society". He is currently writing a book on rural electrification in the United States.

Joyce Bedi, Curator for seven years (1983-1990) and acting director on several occasions, has completed her coursework for a Ph.D. in the history of technology from the Hagley program at the University of Delaware. She is beginning research for a dissertation on the strobe photography pioneer and IEEE Fellow Harold Edgerton. Her professional activities include chairing the selection committee for the Society for the History of Technology's Dibner Award, chairing the Technology Museums Special Interest Group and editing their newsletter, "Artifactory." ■

Ellis Promoted

The Center is proud to announce the promotion of Michael Ann Ellis to the position of Assistant to the Director. Those of you who have dealt with the Center in the year and a half that she has worked here can no doubt recall the enthusiastic personability she brings to her work. In her new position, Ellis will employ those skills to assist the Director execute his professional and managerial duties. ■

Center Adds Historian

We are pleased to announce the most recent addition to the Center's staff. Dr. Loren Butler will be joining the Center as Research Historian in early 1993. She holds a B.A. degree in mathematics from Princeton University, an M.A. degree in mathematics from the University of Michigan at Ann Arbor, and a Ph.D. in conceptual foundations of science from the University of Chicago. During her graduate training at Chicago, she spent several years working at the University of California at Berkeley with John Heilbron, a leading scholar of the history of electricity. Dr. Butler's recently completed dissertation analyzes the history of mathematical physics and applied mathematics in the United States. At the Center, her main responsibility for the next several years will be to co-author the Center's one-volume history of electrical technology, *Power and Control.* ■

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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FRIENDS

Programs

The Center continues to work hard to preserve the history of electrical engineering and spread the word widely to electrical engineers, students, and the general public. Only about half of our funding comes from the IEEE General Fund. The rest comes from Rutgers, project grants, and contributions from companies, foundations, and individuals like you. We need and appreciate your help to continue our work developing archives, exhibits, oral histories, popular articles, conferences, milestones, teaching, and research.

We have two programs by which companies, foundations, and individuals can help to support the Center's activities: through an annual gift to the Friend's Program or a lifetime gift to the Partnership Program. Whether you give to the Friends Program or the Partnership Program, you gift is tax-deductible and its use is overseen by the Friends Committee, a group of distinguished electrical engineers appointed by the IEEE Foundation. Partnership donations not earmarked for a specific project are treated like endowment funds, as a means to provide continuing support to the Center. Some Friends contributions are used for current projects, while others are treated like endowment funds. All donations to either the Friends Program or the Partnership Program should be made payable to the "IEEE Foundation Friends Fund."

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Partnership contributions may be pledged and fulfilled over a three-year period. ■

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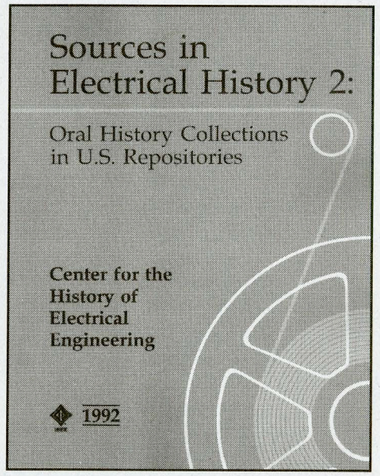
KBR Foundation

The Center is pleased to announce a new Associate Partner: the KBR Foundation of Leesburg, Virginia. The gift from the KBR Foundation was given in memoriam of William F. Rust, Jr., a Life Senior Member of IEEE who joined the Institute as a student in 1935. This tribute to Mr. Rust's memory will live on as part of the Center's endowment.

A complete list of our Partners can be found on the back page of this newsletter. ■



Sources in Electrical History 2: Oral History Collections in U.S. Repositories is a recent Center publication supported by a grant from the Friends Fund.

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Power and Control
(continued from page 1)

increasing roles of government, the military, and academia in research and development. Technological trends will be described, such as the move, in many applications, from mechanical to electromechanical to electrical to electronic (even, in some cases, to photonic); the move from analog to digital; automation and miniaturization; and the use of an increasing part of the electromagnetic spectrum. The need to view a technology as part of a social system will be emphasized throughout, and the social effects of technology, both good and bad, will be discussed.

The product will, we hope, be a comprehensive, well-illustrated, and readable one-volume history of electrical engineering, presenting a contextual and technically accurate account of the development of electrical engineering science and its main applications. It is our intention that this be a book every engineer will want to read and *the* book that people will turn to in order to understand the development of the field of electrical engineering and its ever-increasing role in modern society. We plan to publish the book with IEEE Press, perhaps in collaboration with a high-quality mass-market publisher who can more effectively reach the educated public. ■

POWER AND CONTROL: A HISTORY OF ELECTRICAL, ELECTRONIC, AND COMPUTER TECHNOLOGY

Introduction: Harnessing electrons

Chapter 1: Creating electrical science, 1700 - 1900: empirical discoveries and theoretical formulations (Franklin, Volta, Oersted, Ampere, Faraday, Henry, Ohm, Kirchhoff, Maxwell, Hertz), the lightning rod

Part I: **The achievement of instantaneous telecommunications, 1830 - 1883**

Chapter 2: The telegraph and the telephone: Gauss and Weber, Cooke, Morse, Wheatstone; submarine telegraphy (Thomson); Siemens & Halske, Western Union; military, business, and scientific uses; Society of Telegraph Engineers; Bell, telephone companies

Chapter 3: Other uses of electricity: electroplating and electrochemistry; electromagnets; primary batteries; generators (Wilde, Siemens, Pacinotti, Gramme); motors; arc lighting (Staite, Brush, lighthouses); instruments

Part II: **Electric lighting and the new profession of electrical engineering, 1884 - 1900**

Chapter 4: Electric lighting: development of incandescent lighting (Edison, Swan, Tesla); Edison's Pearl Street station; competition between gas, arc, and incandescent lighting

Chapter 5: Electric power: improvements in generators and motors; transformers; Tesla; Battle of the Systems; electroprocessing; business and domestic uses of electricity (elevators, escalators, fans, pumps), electric trolleys (Sprague, van Depoele), subways, electric cars; the storage battery

Chapter 6: Professionalization: AIEE and IEE; EE education; Kelvin, Heaviside, Steinmetz, and EE science; electrical units and industrial standards, electrical measurements (Weston); telephone switching and the loading coil

Part III: **The establishment of electrical power and wireless communication, 1901 - 1920**

Chapter 7: Electricity in industry: electrical manufacturers (GE, Westinghouse, Siemens, Brown-Boveri), power companies; improvements in generators (turboalternator), motors, and insulators; electric power in manufacturing and mining; cooperative engineering courses

Chapter 8: Radio telegraphy and telephony: Marconi, Tesla, Fessenden, electron tubes (Fleming, De Forest), IRE, Alexanderson alternator, Armstrong's superheterodyne, radio in World War I, amplifiers and microphones, amateur radio, RCA, the global radio system

Chapter 9: Advancing technologies: industrial R&D (Edison, GE, Bell), test and measurement (oscilloscope), solenoid valve, long-distance telephony and automatic switching, teletypewriter, electric phonograph, magnetic recording, and motion pictures, electricity in medicine and dentistry (x-rays, electrocardiography)

Part IV: **Electrical technology enters the home, 1921 - 1939**

Chapter 10: Radio technology and broadcasting: RCA, Sarnoff, technical advances (Raytheon, Westinghouse), directional antenna, spectrum expansion (shortwave), FM, investigations of the ionosphere; broadcasting in different countries (commercial and government-run), radio's golden age

(continued on page 9)

Technical Activities Liaisons

Electrical technology has expanded so rapidly and many areas have become so technically complex that it is important for the Center to obtain guidance from technical experts who have a historical sense of their discipline. With this objective in mind, the Center has recently worked with IEEE Society Presidents to form a Technical Activities History Liaison Committee. The first tasks of this committee are to advise the Center on candidates for formal oral history interviews and to provide technical guidance on the one-volume history of electrical engineering the Center has just begun to prepare.

Members of the Technical Activities History Liaison Committee:

Antennas and Propagation	William F. Croswell	Nuclear and Plasma Sciences	W. Kenneth Dawson
Broadcast Technology	Noel Luddy	Power Electronics	Philip L. Hower
Consumer Electronics	David M. Lewis	Power Engineering	Chen-Ching Liu
Electromagnetic Compatibility	Chester L. Smith	Reliability	Alan Plait
Engineering in Medicine and Biology	Herman Schwan	Robotics and Automation	Vincent Hayward
Information Theory	Anthony Ephremides	Signal Processing	James F. Kaiser
Lasers and Electro-Optics	Anthony J. DeMaria	Social Implications of Technology	Ronald Kline
Microwave Theory and Techniques	Theodore Saad	Systems, Man, and Cybernetics	Julian Reitman
Neural Networks (Council)	Robert J. Marks II	Ultrasonics, Ferroelectrics, and Frequency Control	Arthur Ballato

We are working with the presidents of the other Societies to find suitable representatives. If your technical society is not yet represented on this committee and you think you might like to serve in this capacity, the Center urges you to contact your Society President. We are seeking people who have a good technical and historical overview of their society's field of interest. ■

Sarnoff Center 50th Anniversary

The David Sarnoff Research Center celebrated its 50th anniversary on Thursday, September 24, 1992 with a tour of the facility and exhibitions of some of the technologies developed there. Highlights of the evening included a glimpse of the office and library of David Sarnoff, the illustrious chairman of RCA, an exhibit of historic photos, and demonstrations of advanced digital HDTV (high definition television) and face-recognition equipment.

The Center was established in 1942 as RCA Laboratories and renamed in Sarnoff's honor in 1951. In the past fifty years, the laboratory has made numerous technological innovations, notably in the area of television. In the 1950s, the Sarnoff Center was instrumental in promoting the adoption of NTSC standards for all-electronic color television. More recently, it has performed a similar function in helping to establish standards for stereo television transmission and HDTV. Other significant contributions include liquid crystal displays, CMOS, and charge-coupled device image sensors.

In April 1987, the Sarnoff Research Center became a client sponsored research company and a subsidiary of SRI International, of Menlo Park, CA. ■

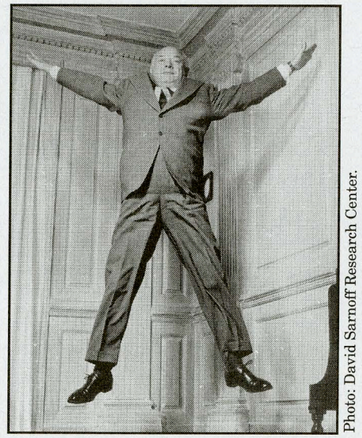

Photo: David Sarnoff Research Center.

David Sarnoff in a light moment.

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

Bromberg, Joan Lisa, *The Laser in America, 1950-1970* (Cambridge MA: MIT Press, 1991), xiv + 310 pp.

In a clear and well-researched book, Dr. Joan Lisa Bromberg traces the development of a crucial 20th century technology that has been important to science, industry, and the military. After setting the stage for the postwar electronics research in the United States, Bromberg describes the work of Charles Townes and others that led to a working maser at the end of 1953, a solid-state maser in 1956, and numerous maser applications by the end of the decade. There follow three chapters on, respectively, the invention of the laser, the burgeoning of laser research in the early 1960s, and the early applications of lasers. In the final chapter the author considers social and well as technical factors in explaining why lasers were invented when and where they were.

Between 1982 and 1988, four societies, one of them the IEEE Lasers and Electro-Optics Society, sponsored The Laser History Project, a program to conduct oral-history interviews and collect documentation pertaining to the invention of this the laser. Dr. Bromberg was project director, and *The Laser in America* was written as part of the project. Its interpretations, however, are those of the author. ■

Kline, Ronald R., *Steinmetz: Engineer and Socialist* (Baltimore MD: Johns Hopkins University Press, 1992), xii + 401pp.

In this impressively researched and analyzed study, Ronald Kline investigates the many sides of Charles Proteus Steinmetz, the impoverished, German-emigré, hunchbacked dwarf who rose to become chief of engineering at General Electric. The book gives a careful reading of Steinmetz's important contributions to the theory of magnetic hysteresis, the analysis and design of AC circuits and equipment, and high-voltage power transmission. Detailed examination is made of Steinmetz's important role in developing mathematical tools that could be used in electrical engineering, including his famous method of complex numbers for studying AC circuits.

One of the book's greatest strengths is its reach beyond Steinmetz's technical contributions. Steinmetz's important roles in building up a research infrastructure at General Electric, providing leadership in the American Institute of Electrical Engineers, and advancing electrical engineering education receive careful examination. More unusual is Kline's analysis of Steinmetz's socialist activities in contrast to the political conservatism of General Electric, and of GE's public relations campaign to build on Steinmetz's mystique. Throughout the book, Kline builds on the existing literature of the history of technology in order to provide greater context and make his scholarship have significance beyond the career of this one distinguished engineer and socialist. ■

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Frost, Robert L. *Alternating Currents. Nationalized Power in France, 1946-1970*. Ithica, NY: Cornell University Press, 1991.

Faraday

Last year's bicentennial of the birth of Michael Faraday stimulated a considerable historical interest in the great experimentalist. Those interested in Faraday will want to make a point of examining some of these recent historical publications about his life and work.

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Power and Control

(continued from page 4)

Chapter 11: Electrical appliances and early television: power industry, rural electrification (TVA), impact of the Depression on the electric industry; refrigerator, washing machine, toaster, vacuum cleaner, oven, water heater, iron; sound motion-pictures and public-address systems; early television (Baird), all-electronic TV (Zworykin), early TV broadcasting

Chapter 12: Instruments, standards, and curricula: power electronics, components (vacuum tubes, magnetron, klystron), measuring instruments, control systems (autopilot), differential analyzer, electron microscope, electrification of business machines, neon and fluorescent lighting, graduate education (Jackson, Terman)

Part V: **The Wizard War, 1939 - 1945**

Chapter 13: Radar: developments in England, the U.S., Germany, and Japan; variety of radars; radar countermeasures; IFF; loran; government-industry-academia collaboration

Chapter 14: The ubiquitous electron tube: printed circuits, communications, proximity fuse, sonar, airborne TV, magnetic detection, night vision, fire control, Colossus, ENIAC

Part VI: **The establishment of electronics, 1946 - 1960**

Chapter 15: Television and other consumer products: technical advances in TV, standards, broadcasting, color TV, video recording (Ampex, RCA); high-fidelity and LPs; home appliances (refrigerator-freezer, air conditioner, automatic washer, dryer, dishwasher); long-distance direct dialing

Chapter 16: Computers: analog computers; vacuum-tube computers (IAS Computer, Univac, IBM 701), magnetic-core memory; transistorized computers; assemblers and compilers, computer languages (Fortran); information theory

Chapter 17: The transistor and more: transistor (Bell, TI), military and government sponsorship of R&D, avionics, maser, laser, electron beam technologies, components, nuclear power (Shippingport), xerography (Carlson), EE in science (accelerators, radio astronomy, instruments); nationalization of power and communications industries

Part VII: **The miniaturization of electronics, 1961 - 1976**

Chapter 18: Miniaturization: planar process (Fairchild), field-effect transistor, integrated circuit, IBM 360, microprocessor (Intel), minicomputers (DEC), supercomputers (Cray); Japanese electronics manufacturing

Chapter 19: Military and scientific electronics: avionics; missiles; space program (Apollo); satellites, including communications satellites (Telstar); medical technology (pacemaker, CAT, electron microscope, ultracentrifuge, hearing aid)

Chapter 20: Industrial power and control: nuclear-power industry, electronics in industry, control systems, numerical process control, electronic telephone switching, lasers, holography, fiber optics (Corning), programming languages, formation of IEEE

Part VIII: **The information society, 1977 - 1990**

Chapter 21: The personal computer: the PC market, proliferation of uses (information management, CAD/CAE/CAM, automation, educational, recreational), computer communications and digitization, AI, neural networks, computer imaging

Chapter 22: Disseminating electrical technology: communications, traffic control, satellites for communications and data gathering, electronics in the home (cable TV, microwave oven, VCR, camcorders, CDs, videodisks, HDTV, large-screen TV), electronic instruments in science (particle accelerators), biomedical engineering

Chapter 23: Electrical technology for the future: industrial and commercial standards, applications of lasers, opto-electronics, robotics, applications of superconductivity, fusion research, science-based engineering, controversy over the health hazards of CRTs and electromagnetic fields

Summary

Chapter 24: The sciences of electrical engineering, 1900 - 1990: electromagnetic theory, quantum mechanics, solid-state physics; information theory, control theory, network theory, operations research, numerical analysis, fuzzy logic; relationship between electrical technology and the sciences of electrical engineering

Conclusion: 150 years of progress

Endnotes (including a bibliographic essay for each part)
Appendix: Chronology
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Note: Each part begins with a setting of the historical scene. There follows one or two chapters devoted to a particular story. The final chapter in each part deals with other developments in the period and reviews aspects of the state-of-the-art and the state-of-the-profession not covered in the other chapters in that part.

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Programming Language History

The Special Interest Group in Programming Languages of the Association for Computing Machinery will sponsor its second History of Programming Languages Conference on April 20-23, 1993, in Cambridge, MA. The conference will update many of the themes introduced at the first, ACM/SIGPLAN History conference, held in 1978. In addition to the sessions dedicated to a number of languages, there will be a forum on the practice of the history of computing, discussing such issues as documents, archives, journals, conferences, university courses, writing and teaching. For more information, please contact J.A.N. Lee, Department of Computer Science, Virginia Tech, Blacksburg, VA 24061-0106, telephone (703) 231-5780.

A more narrowly focused event will be the one-day conference on the history of the programming language Algol 68 to be held in Amsterdam on February 11, 1993. The program for this meeting includes talks about various aspects of Algol 68 as well as a general survey of the history of programming languages. Scholars speaking are Friedrich Bauer, Charles Lindsey, Cees Koster, Sietze van der Meulen, Lambert Meertens, and John Peck. For more information, please contact Gerard Alberts, CWI-AM, P.O. Box 4079, NL-1009 AB Amsterdam, The Netherlands, telephone 31 80 615986. ■

Workshop in Cuba

A workshop on the history of electrical technology in Cuba and the USA, scheduled to be held January 25-28, 1993 in Havana, Cuba, is being organized by the the Cuban Society of History of Science and Technology and the Study Center for History and Organization of Science, a research institute within the social-sciences section of the Cuban Academy of Sciences.

The term "electrical technology" is a comprehensive denomination including such areas as electric power, telecommunications, and computer science. The workshop is intended as a forum for historical appraisals of scientific and technical aspects and their social and economic context. Since electrical technology in Cuba was linked, for many years, with U.S. technological development, the workshop will be focused on the history of this technology in both countries, in the 19th and 20th centuries. Papers will treat such subjects as the first Cuba-U.S. telephone link by submarine cable and the rise of the International Telephone and Telegraph Corporation, sugar-mill electrification in Cuba, first steps of radio communication in Cuba (1899-1916), Havana as a proving ground for new automatic telephone exchange systems since 1910, and the introduction of frequency-modulated radio in Cuba. Spanish and English will be the working languages. Translation will be available if necessary. For more information, contact Joan Lisa Bromberg, University of California at Davis, Davis, CA 95616-8673, telephone (916) 739-0544. ■

Electronics in Europe

There will be a one-and-a-half day conference sponsored by the Centre de Recherche en Histoire des Sciences et des Techniques considering European research, business, and political responses to the post-war electronics challenge held in Paris on May 27-28, 1993.

The objective of this international conference is to examine with a comparative perspective research, business and state responses to the semiconductor electronics challenge. These include the related aspects of organizational changes, research practices, business strategies, industrial policy, and public perceptions.

For more information, please contact Antonio Botelho, Kellogg Institute, University of Notre Dame, Notre Dame, IN 46556, telephone (219) 239-7674 or François Jacq, Centre de Sociologie de l'Innovation, École de Mines, 62 Bd. Saint Michel, 75272 Paris Cedex 06, France, telephone 33 1 40 51 92 82. ■

MUSEUM

Yokogawa Electric Museum Project

A museum of measurement is being organized by Yokogawa Electric, one of Japan's leading firms in the field of electrical meters, measuring instruments, and industrial instrumentation. Yokogawa Electric, which has been deeply involved with leading U.S. companies, once participating in technology licensing agreements with the Foxboro Company and presently engaged in a joint venture partnership with General Electric and Hewlett-Packard, plans to include U.S. technologies, as well as those of Europe and Japan, in its displays, which are slated to open in Tokyo in 1996.

Overview of the Museum:

Goal: The museum traces the evolution of measurement technologies, and their contributions to society, from the dawn of measuring instruments up to the present. The museum aims to present exhibits which will be informative to everyone, from elementary and junior high school students and the general public on through experts in the field.

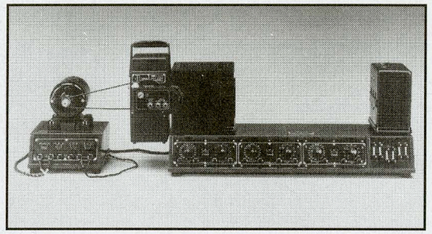

Photo: Yokogawa Electric

Model N-3 electromagnetic oscillograph developed by Yokogawa Electric in the 1920s.

Scope: The collection encompasses electrical meters, measuring instruments, electronic measuring technologies, and industrial instruments from the earliest days after the industrial revolution. It includes American and European instruments, traditional Japanese weighing and measuring devices, and instruments which have been key influences in the evolution of the Japanese instrument industry from Yokogawa Electric's founding in 1915 to the present.

Themes: The exhibits will show the advent and development of measuring instruments, their role in society, and their impact on society. It will include a section showing where today's technologists meet the outstanding ideas of their predecessors.

Current Exhibits:
In addition to Yokogawa Electric products, the collection includes electrical meters by Weston Instruments, General Electric, and other manufacturers of the second half of the 19th century—articles such as an automatic balancing recorder designed by Longbourne Callendar and woodblock prints used for instruction in weights and measures in Japanese primary schools during the Meiji era (the late 19th century.) Including gifts from individuals and items on loan from other museums, more than 4,000 artifacts have been collected and painstakingly restored.

It will be sometime before the museum opens, but the activities in preparing the exhibits, and the information gained thereby, have already been discussed by engineering societies in Japan, and parts of the collection have been exhibited at the Japanese National Science Museum. In the meantime, Yokogawa Electric has exhibited some of the restored items at their headquarters in Tokyo.

Future Plans:
This museum aims to amass a collection of rare and valuable measurement artifacts. The present plan calls for a grand opening to the general public in 1996 at a location near the Yokogawa Electric headquarters. For more information, please contact Mr. Eiju Matsumoto, Yokogawa Technology Museum Office, Yokogawa Electric Corporation, 2-9-32, Nakacho, Musashino-shi, Tokyo 180, Japan. ■

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Photo: Yokogawa Electric

Eiju Matsumoto standing in front of a model 204C audio oscillator, manufactured by Hewlett-Packard in the 1940s.

IEEE/SHOT Prize

At the August 1992 meeting of the Society for the History of Technology in Uppsala, Sweden, Donald MacKenzie was awarded the 1992 IEEE Life Member Prize in Electrical History for his article, "The Influence of the Los Alamos and Livermore National Laboratories on the Development of Supercomputing" (*Annals of the History of Computing* 13, no. 2 (1991): 179-201) Dr. MacKenzie's paper considers the history of computer architectures, particularly parallel architectures, and the role of the large, publically-funded research and development organizations often called "national laboratories."

The IEEE Life Members' Prize in Electrical History is sponsored by the IEEE Life Members Fund, awarded by the Society for the History of Technology, and administered by the Center. The prize is awarded annually for the best paper on the history of electrical technology published during the preceding year. ■

Radio Magazine

A magazine dedicated to aficionados of vacuum tube radios, published by an amateur operator based in Colorado, is available for subscription. The magazine, called "Electric Radio," is published monthly. Each issue contains approximately 40 pages, printed on high-quality paper that reproduces photographs well. Articles range in subject from interviews of persons associated with the design, manufacture, and use of vintage radios to helpful tips on rehabilitating and maintaining "radios that glow in the dark." The magazine also serves as a bulletin board for radio buffs to swap notes. For more information, please contact Barry R. Wiseman, N6CSW/0, Box 57, Hesperus, CO 81326, telephone (303) 247-4935. ■

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We are grateful to the organizations and individuals listed below, who provide generous support to the Center in the form of operating, endowment, and project funding. If you or your organization are interested in joining our Partnership Program, please contact the Director, Dr. William Aspray.

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Thanks to the Microwave Theory and Techniques Society for providing money for the Rab-Lab Oral History Project.
We are also grateful to the hundreds of individuals who have contributed to our Friends Fund.

Computer Fellowship

The Charles Babbage Institute is accepting applications for the Adelle and Erwin Tomash Graduate Fellowship to be awarded for the 1993-94 academic year to a graduate student whose dissertation will address some aspect of the history of computers and information processing. Topics may be chosen from the technical history of hardware or software, economic or business aspects of the information processing industry, or social, institutional or legal contexts of computing.

There are no restrictions on the venue of the fellowship which pays $10,000 plus an amount up to $2,000 for tuition, fees, and other approved research expenses.

Complete application materials should be received by January 15, 1993. For more information, please contact Charles Babbage Institute, University of Minnesota, 103 Walter Library, 117 Pleasant Street S.E., Minneapolis, MN 55455, telephone (612) 624-5050. ■

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Through the course of the year, many generous members offer the Center their collections of IEEE journals, engineering textbooks, or other technical publications. The Center accepts only a small number of these donations because of our limited space and the good library facilities available to us at Rutgers, IEEE, and the Engineering Societies Library.

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