

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

Mailing address:
Rutgers University
39 Union Street
New Brunswick, NJ 08901-8538 USA
Telephone: +1 732 562 5450
Fax: +1 732 932 1193
Email: ieec-history@ieee.org
URL: www.ieee.org/history_center

IEEE History Committee 2010

Michael R. Williams, Chair
Jacob Baal-Schem
David E. Burger
Jonathan Coopersmith
Lyle D. Feisel
Mortimer Hans
Lori Ellen Hogan
Daniel D. Hoolihan
Don H. Johnson
Joseph A. Kalasky
W. K. King
Alexander B. Magoun
Thomas J. Misa
Eiichi Ohno
Harold Wallace

IEEE History Committee Staff

Michael Geselowitz, Staff Director
m.geselowitz@ieee.org
Sheldon Hochheiser, Archivist and Institutional Historian
s.hochheiser@ieee.org
Frederik Nebeker, Senior Research Historian
f.nebeker@ieee.org
John Vardalas, Outreach Historian
j.vardalas@ieee.org
Robert Colburn, Research Coordinator
r.colburn@ieee.org
Nathan Brewer, Web Content Administrator
n.w.brewer@ieee.org

IEEE prohibits discrimination, harassment and bullying.
For more information visit
<http://www.ieee.org/nondiscrimination>

© IEEE information contained in this newsletter may be copied without permission, provided that copies for direct commercial advantage are not made or distributed, and the title of the IEEE publication and its date appear on each copy.

IEEE HISTORY COMMITTEE INVITES ORGANIZATIONAL UNITS TO NAME CORRESPONDING MEMBERS

In order to broaden its reach and stimulate historical activities within the organizational units of IEEE, the the History Committee invites all IEEE organizational units to name Corresponding Members of the History Committee. Corresponding Members may also be appointed from non-IEEE organizations active in the history of technology. (Examples include, but are not limited to: the International Committee for the History of Technology, the Society for the History of Technology, the American Society of Mechanical Engineers History Committee, and government or educational organizations.) Corresponding Members of the History Committee receive all electronic communications – except for invitations to teleconferences – received by regular members of the Committee, including but not limited to: Agendas, Minutes, draft Minutes, Milestone Report, and the History Center newsletter. For regular members, travel expenses to all meetings, and telephone expenses are reimbursed according to standard IEEE practice. Corre-

sponding members are invited to attend any face-to-face meetings, and to participate fully (without vote), but their expenses are not reimbursed by the History Committee. Their home organizational unit may choose to reimburse them. There is no limit to the length of time a corresponding member may serve.

The role of Corresponding members shall be to report back to their organizational units on activities and discussions of the IEEE History Committee, and to report on their organizational units' history activities to the IEEE History Committee. Corresponding members shall also be eligible to serve as milestone advocates.

Organizational Units who wish to name a corresponding member to the IEEE History Center should send an email to IEEE History Committee Chair Michael Williams at m.williams@computer.org or ieec-history@ieee.org. The email should include the corresponding member's name, e-mail address, and brief biography.

NEWSLETTER SUBMISSION BOX

The IEEE History Center Newsletter welcomes submissions of Letters to the Editor, as well as articles for its "Reminiscences" and "Relic Hunting" departments. "Reminiscences" are accounts of history of a technology from the point of view of someone who worked in the technical area or was closely connected to someone who was. They may be narrated either in the first person or third person. "Relic Hunting" are accounts of finding or tracking down tangible pieces of electrical history in interesting or unsuspected places (ones in situ and still operating are of particular interest). Length: 500-1200 words. Submit to ieec-history@ieee.org. Articles and letters to the editor may be edited for style or length.

THE IEEE HISTORY CENTER NEWSLETTER ADVERTISING RATES

The newsletter of the IEEE History Center is published three times per annum; one issue (March) in paper, the other two (July and November) electronically. The circulation of the paper issue is 4,800; the circulation of the electronic issues is 22,500. The newsletter reaches engineers, retired engineers, researchers, archivists, and curators interested specifically in the history of electrical, electronics, and computing engineering, and the history of related technologies.

	<u>Cost Per Issue</u>
Quarter Page	\$150
Half Page	\$200
Full Page	\$250

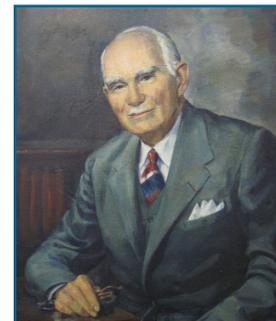
Please submit camera-ready copy via mail or email attachment to ieec-history@ieee.org. Deadlines for receipt of ad copy are 2 February, 2 June, 2 October. For more information, contact Robert Colburn at r.colburn@ieee.org.

COLLECTING THE HISTORY OF THE IEEE HISTORY CENTER

As part of the 30th anniversary of the IEEE History Center, IEEE Archivist and Institutional Historian Sheldon Hochheiser contacted five key individuals in the center's history for their recollections. Dr. James Brittain, long time member and former chair of the IEEE History Committee was the person most responsible for guiding IEEE to establishing the center. He contributed a written memoir of the process. His recollections have been added to the IEEE Archives collection. In addition, Dr. Hochheiser has scheduled oral history interviews with the first and second center directors, Dr. Robert Friedel (now at the University of Maryland), and Dr. Ronald Kline (now at Cornell University), as well as with long-time IEEE history committee member and chair Dr. Bernard "Barney" Finn (Curator Emeritus at the Smithsonian). Dr. Finn is also donating material on the history center and the history committee in his possession. The center's third director, Dr. William Aspray (now at the University of Texas—Austin) has also agreed to be interviewed.

THE DEFOREST PORTRAIT – AN INTRIGUING REFERENCE REQUEST

The History Center receives many intriguing reference requests from scholars, historians, electrical engineers, journalists, government policy offices, and members of the general public. Recently, the granddaughter of radio pioneer and audion tube inventor Lee de Forest contacted the Center looking for help tracking down the portrait of deForest portrait painted by her mother Harriet deForest, Lee deForest's daughter, in February 1952. The painting was done for the IRE building, then located at 1 East 79th Street, New York City (the Brokaw mansion), and accepted by Joan Coggeshall on behalf of IRE President Donald Sinclair.



IEEE History Center staff did some sleuthing and were able to ascertain that the portrait is the one which currently hangs in the meeting room area of the IEEE Operations Center in Piscataway, New Jersey, roughly across from the portrait of radio pioneer Alfred Goldsmith.

THE IEEE HISTORY CENTER: 30 YEARS OF PRESERVING THE HISTORY OF THE PROFESSION

Since the formation of IEEE in 1963, there has been a standing History Committee responsible for promoting the collection, writing and dissemination of historical information in the fields covered by IEEE technical and professional activities, as well as historical information about the IEEE and its predecessor organizations.

In 1979, the IEEE Board of Directors endorsed the concept of a professionally staffed history center to support the work of the IEEE History Committee and allocated funds, and in 1980, the Center for the History of Electrical Engineering was established in the New York offices of the IEEE. For most of the first decade, the Center staff consisted of a director, an archivist or curator, and a part-time research assistant. The first director was Dr. Robert Friedel, and Dr. Ronald Kline succeeded him in 1984. They and their staff laid the groundwork for the Center, establishing it as a leading resource for electrical history.

The Center undertook many projects during its first decade. Most notable, perhaps, were three exhibits that circulated nationally: the first on Faraday and Maxwell, the second on the IEEE Centennial, and the third on Edison and the electric light. In addition, the Center collaborated on exhibits with the Smithsonian and other institutions. Perhaps most importantly the Center established the IEEE Milestones Program, overseen by the History Committee, wherein IEEE Sections could recognize and publicize engineering achievements within their geographical area.

Move to Rutgers and Program Expansion 1989-1997

At the end of the decade, the History Committee determined that the Center should become a place where considerable historical research would be carried out. This decision was heavily influenced by a report prepared for the Committee by historian Terry Reynolds. In order better to carry out research, the Center moved in 1990 to the campus of Rutgers University in New Brunswick, New Jersey. This move was carried out under the leadership of the Center's third director, Dr. William Aspray, who had been hired in 1989.

With University support added to IEEE support, the Center was able to expand to a staff of three permanent Ph.D. historians, a rotating post-doc, a curator, a research assistant, and four (later six) Rutgers graduate-students working part-time as research assistants. Dr. Rik Nebeker joined the staff in 1990 as Research Historian. He has since been promoted to Senior Research Historian.

Center staff carried out and published research projects on the National Science Foundation's role in the development of computing, the impact of the computer on meteorology, the history of the electric trolley, the history of radar, and many other topics. Oral history became a major activity; the Center conducted more than 200 interviews in this period. The interviews were transcribed, edited, and made available to researchers. The Center started a series of international conferences on the history of technology with conferences in

Continued on Page 4

1991 in New Jersey on Technological Competitiveness, 1995 in Williamstown, Massachusetts on the history of Electrical Engineering, and 1997 in Williamsburg, Virginia on the history of computing. Long-term cooperation was begun with sister groups, such as the History Committee of the IEEJ (Japan's counterpart to the IEEE).

New Director, Emphasis, and Name: IEEE History Center 1997-2010

In 1997, Dr. Michael Geselowitz became the Center's Staff Director. With the guidance of the History Committee, the Center embarked on a new phase in its own history, characterized by an increased emphasis on reaching out to engineers, to public-policy makers, to public-school teachers, and to a fourth, sometimes overlooked group of people concerned with electrical history—amateur historians and collectors. Shortly thereafter, the Center acquired a new name, the IEEE History Center. It more accurately described the scope of the Center's activities. In 1998 Geselowitz, Nebeker, and the post-doc were joined in these efforts by Robert Colburn as Research Coordinator, as well as by an archivist/web manager. Projects carried out by this team include a major overhaul of the Center's web site, several IEEE Society histories, teaching and participating in the intellectual activity at Rutgers University, a workshop with the IEEJ in 2000, the "Going Digital" web history project sponsored by the Sloan Foundation, two more of the international conferences (1999 in New Brunswick, New Jersey, USA, on women and technology; 2001 in St. John's, Newfoundland, Canada, on the history of telecommunications).

The Center also began a more concerted effort to get word on history out to the IEEE membership, beginning features in many IEEE publications, including a series of special millennium articles in Proceedings of the IEEE, a regular column in *The Institute*, occasional special articles for *IEEE Spectrum*, and regular e-features for *Spectrum* and *Today's Engineer*. In 2000, the History Center also increased its move in the direction of public outreach with the introduction of an entirely new web-based program, the IEEE Virtual Museum. This program was discontinued in 2008, and most of its articles were migrated to the newer IEEE Global History Network.

In 2003, the History Center staff was responsible for Philosophy Hall at Columbia University in New York being named a U.S. National Historic Landmark (this is the building where Edwin Armstrong, winner of the first IEEE Medal of Honor in 1919, when it was the IRE, did most of his pioneering radio work). The Center also worked on a special project to copy to DVD and make accessible some very important privately held video interviews with computer pioneers. In 2004, the Center held its next conference at Bletchley Park, Milton Keynes,



Kuniaki Tanaka (left) with former Center Director William Aspray in front of the Center.

England on the history of electronics.

Perhaps most importantly, the Milestones Program passed its own Milestone in 2004, as the 50th Milestone was dedicated and IEEE Region 9—the last Region without a Milestone—received two recognitions. By 2010, the number of milestones had passed 100. In addition, we conducted institutional history research projects with Eta Kappa Nu and with the Marconi Fellowship Foundation at Columbia University.

In 2006 and 2007, the History Center was involved in numerous special projects, including Society Anniversaries and Lectures. The oral history program

began videotaping interviews. The IEEE Milestones Program continued to grow at a record pace. In 2007, the Center held its biennial conference, at New Jersey Institute of Technology in Newark, N.J., U.S.A, on the history of electric power. In 2008, John Vardalas, who had started at the Center as a post-doctoral fellow was promoted to Outreach Historian, and Dr. Sheldon Hochheiser joined the center as Institutional Historian and Archivist.

Beginning in 2008, a major focus of the Center's activity became building a new wiki-based website for bringing the history of IEEE's fields of interests to both IEEE Members and the public, The IEEE Global History Network (GHN). The GHN went live late in 2008. While anyone can access the GHN, only IEEE members and staff, and other registered users can add and edit material. To oversee the GHN, Nathan Brewer joined the History Center staff in 2009 as Web Content Administrator. By 2010, the GHN had grown to include thousands of entries, including firsthand accounts by IEEE Members, more than 450 oral histories, articles on the history of technology, selected documents from the IEEE Archives, and articles on the history of IEEE and its organizational units.

In 2009, as part of IEEE's celebration of its 125th anniversary, the History Center undertook two projects. The Center's conference, held at both Drexel University and the University of Pennsylvania in Philadelphia had the theme of the history of professional technical societies. And the Center conducted oral histories with twenty-three IEEE Past-Presidents. The Center began a new program, STARS an online compendium of invited, peer-reviewed articles on the history of major developments in electrical and computer science and technology. STARS articles appear on the GHN. The program was designed to provide recognition to the most important technological trajectories, and thus to complement the Milestone program's emphasis on specific achievements in specific places. The Center also undertook a pilot program with the Hillsborough, NJ school district on bringing the history of technology into high school social studies curricula.

IEEE MERGER COLLECTION AVAILABLE ON GLOBAL HISTORY NETWORK

In 1962, a joint committee of the AIEE and the IRE societies agreed on a set of "Principles of Consolidation," which first the boards, and then the membership, of both societies approved. On 1 January 1963, the Institute of Electrical and Electronic Engineers was born with 150,000 members, 140,000 of whom were in the United States. Now a single society spanned the technologies, the industries, and the academic allegiances of what had become a complex, multifaceted discipline.

Documenting the historic merge, the IEEE Merger Collection contains nearly six hundred primary documents pertaining to the merger of IRE and AIEE in 1963. Spanning from the early 1950s to 1970, the papers in this collection provide a unique look at the state of the profession pre-merger, the general attitude concerning unity in the profession, and various post-merger hindsights and considerations. Correspondence from many prominent individuals such as IRE, AIEE and IEEE Past Presidents Ernst Weber, B. Richard Teare, Donald Fink, L. F. Hickernell, Patrick Haggerty, and Warren Chase are all featured in the collection.

The collection was initially processed, organized, and cataloged into a formal finding aid by George Carlyle Sell in 1978 as a project with the Department of History and Sociology of Science at the University of Pennsylvania. For the first time, the entirety of the collection has been digitized and made available on the IEEE Global History Network for public viewing. The versatile wiki platform of the Global History Network allows for quick linking from the finding aid to prominent figures, events and corporations, making background biographical materials easier to find than ever. The finding aid goes into item-level detail, and is organized into fifty-nine different folders, making the collection extremely accessible and easy to navigate.

The IEEE Merger Collection can be viewed on the Global History Network at: http://www.ieeeahn.org/wiki/index.php/Archives:IEEE_Merger_Collection

Another piece of archival material that has been posted on the GHN is a portion of a video series entitled "The Computer Pioneers". Filmed in 1983 by Richard Solomon, "The Computer Pioneers" is a video oral history project which aims to tell the story of significant developments in the computing industry. Solomon produced oral histories with numerous development teams, the first of which to be posted on the Global History Network is the series on the Weizmann Institute.

Recognized as an IEEE Milestone, the WEIZAC was one of the world's first electronic computers, and the first in Israel. It was designed and constructed in 1954, and operated until the early 1960s. WEIZAC was used for mathematical research, such as solving problems related to the computation of ocean tides; this entailed complex calculations which could not reasonably be performed manually. The calculations carried out using

WEIZAC took hundreds of computer hours, and enabled scientists to chart maps giving a very close approximation of high and low tide fluctuations throughout the world. As a result, the Weizmann researchers predicted the precise location of an amphidromic point (at which high and low tides never occur) in the southern Atlantic. Measurements performed in the wake of the discovery confirmed the existence and location of this point.

Spanning nearly eleven hours of video, this oral history project provides a deep look at the development of one of the world's first electronic computers. Among the interviewees are many of the prominent figures behind the design of the WEIZAC computer such as Chaim Pekeris, Thelma and Gerald Estrin, Zvi Riesel, and Aviezri Frankel. The Weizmann Institute Video Oral History can be viewed in its entirety at: http://www.ieeeahn.org/wiki/index.php/Archives:The_Computer_Pioneers:_Weizmann_Institute_Video_Oral_History



Innovation doesn't just happen.
Read first-person accounts of
IEEE members who were there.

IEEE Global History Network
www.ieeeahn.org

IEEE

HISTORY CENTER WELCOMES SIX GRADUATE ASSISTANTS FOR 2010-2011

The IEEE History Center is pleased to welcome back five graduate assistants – Matthew Friedman, Christopher Hayes, Rochisa Narayan, Megan Schenkelberg, and Ji-Hye Shin – and to welcome new graduate assistant Steven McGrail. These graduate assistants will help edit oral histories and post them on the Global History Network, scan and preserve the Center's archival photograph collection and help with many other tasks.

Christopher Hayes is a returning graduate assistant, majoring in U.S. history and minoring in African-American history. His areas of interest are late-twentieth century black radicalism, particularly the Black Liberation Army, as well as imprisoned black radicals and the freedom movements they formed while held captive.

Matthew Friedman's research focuses on postwar modernity, noise and the destabilization and production of subjectivity in the United States in the 1950s and 1960s. A native of Montreal, Matt worked as a journalist for a decade, for publications as diverse as the Montreal Gazette and the National Post and NetGuide and InternetWeek magazines. He is the author of three books on information technology electronic commerce, one of which was published just in time for the dot-com crash of 2000 and sank into obscurity.

Steven McGrail holds a B.A. in Philosophy from Syracuse University, a Masters from Hunter College. His thesis was "The Press for Peace: Newsmakers, Image, and the Portsmouth Conference of 1905." Currently he is a Ph.D. candidate studying U.S. cultural history, 19th/early 20th century America; national narratives, consumer culture, press and periodical

literature, and regional identities. He has been a paralegal, a museum guide at the San Francisco Museum of Modern Art and at the Palace of the Legion of Honor in San Francisco.

Rochisha Narayan received her Bachelor's and Master's degrees in history from St. Stephen's College, Delhi University, and an M.Phil in history from Delhi University. At Rutgers, her areas of interest include the history of South Asia, Women and Gender history, and Global and Comparative history. Her dissertation examines the interlocking histories of family, caste and politics in colonial north India from the late eighteenth to the early twentieth century.

Meagan Schenkelberg, a fourth year IEEE graduate assistant, is working on her dissertation on seventeenth-century England. She is focusing on the importance of gender in political, social and cultural aspects of the Restoration, particularly how women served as symbols of Charles II's court. Meagan is also co-organizing an interdisciplinary graduate conference on British history for the spring, and beginning in September participating in a monthly dissertation writing seminar at the Folger Shakespeare Library in Washington, DC.

Ji-Hye Shin was born in the Republic of Korea and attended Yonsei University in Seoul, Korea, as an undergraduate and graduate student. She received her MA in international studies with a concentration on American Studies. At Rutgers, she studies US immigration history. Her dissertation will examine the processes of racial and ethnic formation in the nineteenth and twentieth century United States with particular interests in immigrant communities.

JAPAN VISIT BY OUTREACH HISTORIAN VARDALAS

On 24 August, Research Historian Dr. John Vardalas, while in Tokyo, Japan, gave a presentation on the activities of the IEEE History Center and on an overview of the IEEE Global History Network. Jointly hosted by the IEEE Japan Council History Committee and the IEEE Tokyo Section, the presentation was well attended and well received. Following the presentation, additional discussions were held, led by Dr. Eiichi Ohno, the Chair of the IEEE Japan Council History Committee, on the Milestone program. Of particular interest to the members of the Tokyo Section was use of the GHN for proposing and nominating milestones.

Another highlight of Dr. Vardalas's stay in Japan was the visit to the Electrical Power Historical Museum Yokohama. He was fortunate to be given a tour by the General Manager of the museum, Mr. Yutaka Takahashi, Mr. Isao Oki, the Manager of the Research Group, and Mr. Keiichi Hohki, the Associate Vice President of the Central Research Institute of Electric Power Industry. Operated as a public service by the Tokyo Electric Power Company, this museum is a gem. While offering a Japanese perspective to the history of electric power, this museum also gives a

wonderful overview of the subject from a global perspective. Its artifacts are wonderful and bigger than life. How often does one see a large generator sliced open for inspection, or a portion of a large hydroelectric turbine? If you are interested in the history of technology, this museum is a must if you visit Tokyo.

Along with Dr. Eiju Matsumoto and Dr. Eiichi Ohno, History Center staff member Dr. John Vardalas also visited the Toshiba Science Museum.



DISSERTATION ON POWER OUTAGES

Hyunsoo Park, student in the Graduate Program in Planning and Public Policy at Rutgers University, has just completed his Ph.D. degree with a dissertation entitled "The Social Structure of Large Scale Blackouts". It examines major power outages in the United States from 1965 to 2003, viewing them as instances of failure in socio-technical systems. Hyunsoo Park has had contact with the IEEE History Center during his studies at Rutgers, and he thanks the History Center in the acknowledgments of his dissertation. He presented some of his findings at the 2007 conference on the history of electric power that the History Center put on in Newark.



SURF CITY

<http://www.philbrickarchive.org/> An archive remembering George A. Philbrick Researches, Inc. (GAP/R)--a pioneer in electronic analog computing and the company that offered the first plug-in differential operational amplifier (the K2-W) as an innovative circuit component--literally, a true "integrated circuit" in the tube era. Philbrick, incorporated in 1946, based in Boston (later Dedham, MA), was acquired by Teledyne, Inc., in 1966, dba Teledyne Philbrick; in the early '90s it was dissolved into the Teledyne empire and no longer exists. The web archive, originated and maintained by Joe Sousa, has a collection of Philbrick documents, photos, and other memorabilia.

<http://www.analog.com/library/analogDialogue/archives.html> a forum for the exchange of information on circuits, systems, and software, archived back to 1967.

http://www.smecc.org/military_communications.htm the Southwest Museum of Engineering Communications and Computation, maintains excellent website as well as a brick and mortar museum. Contains information on a wide range of military electronics. Their history of the proximity fuse and the shooting down of the V-1 rockets is especially interesting.

EE IN THE MOVIES

ELECTRICAL TECHNOLOGIES IN THE MOVIES: ANSWERING MACHINES

Soon after the telephone was invented, Thomas Edison tried to find a way to record telephone messages. Earlier, he had worked on a machine to transcribe telegraph messages through indentations on paper tape. He thought something similar might work for telephone messages, and he experimented with a diaphragm attached to an embossing point that was held against a sheet of rapidly-moving paraffin paper. Speech caused the diaphragm to vibrate, which then made indentations in the paper. Edison later changed the paper to a metal cylinder with tin foil wrapped around it, and the phonograph was born.

Edison's invention was put to use primarily as a music player and a dictating machine, rather than as a telephone-message recorder. The latter device was the objective of the Danish engineer Valdemar Poulsen when, in 1898, he developed magnetic recording. Poulsen used steel wire to capture the varying magnetic fields of a telephone signal. Like Edison's invention, Poulsen's proved practical in dictating machines.

An automatic answering machine requires more than a means of recording a telephone message. The device must pick up an incoming call, play a message, and then record the caller's message. Though many people tried, it proved difficult to build a practical machine. In the 1930s AT&T developed one, but used it only for internal use in providing time-of-day automatically. An alternative was the telephone answering service,

with operators in centralized offices. Such services became known in the 1950s, and we see one, called Susan-swerphone, in the 1960 movie "Bells are Ringing", starring Dean Martin and Judy Holliday.

The commercial success of answering machines came finally in the 1960s and 1970s. These machines used magnetic-tape recording, rather than magnetic-wire recording. In 1960 the Ansafone, invented by Kazuo

Hashimoto, became the first answering machine to be sold in significant numbers in the United States. Other machines soon followed, notably the PhoneMate Model 400 in 1971. An early automatic machine is shown in the 1955 movie "Kiss Me



A 1960 Ansafone

Continued on Page 8

Deadly". It consists mainly of a large, wall-mounted tape recorder. It is interesting that the owner of this machine, the detective Mike Hammer, uses it to screen calls: we see him, on one occasion, first listen to who is calling before he picks up. In the 1979 movie "China Syndrome" we see someone rewinding the tape in order to hear the messages on an answering machine.

It was in the 1980s that answering machines became fairly common, and many movies from that decade show them in use. An answering machine plays a major role in Pedro Almodóvar's 1988 movie "Women on the Verge of a Nervous Breakdown". In "New York Stories" (1989) a woman breaks off a relationship by leaving a message on the man's answering machine. In "Ferris Bueller's Day Off" (1986) the title character makes clever use of answering machines, including to give false messages.

Answering machines cause embarrassment in "My Best Friend's Wedding" (1997), where a message being left on a machine is heard by all the people at a dinner party. A similar thing happens in "Intimate Strangers" (2004). Obsessive behavior is shown in "Swingers" (1996), where the main character frequently checks for a message from his ex-girlfriend, also in "Let It Snow" (1999) and "Chuck & Buck" (2000), where a charac-

ter listens repeatedly to a message left on his machine.

The use of an answering machine to screen calls is shown in many movies. In "Short Cuts" (1993) someone uses an answering machine to avoid harassing calls. In "As Good as It Gets" (1997) the parents of one of the main characters never pick up when their son calls. In "The Closet" (2001) a woman uses an answering machine so as not to take calls from her former husband.

Users found other ways to use answering machines. In "How to Lose a Guy in 10 Days" (2003) Andie Anderson, trying to be annoying, leaves 17 messages on an answering machine. In "3 Iron" (2004) a young man, who finds unoccupied homes to stay in, checks the home's answering machine, often learning from the message that the residents are away. A character in "Darjeeling Limited" (2007) knows the code for his ex-girlfriend's answering machine, and he checks her messages.

A technological change is apparent around the turn of the century, as tapeless answering machines, which use solid-state memory, became available in the mid 1990s. An early movie showing such machines is "First Wives Club" (1996). As always, we would be grateful for reports from readers of other interesting movie scenes that involve answering machines. You may contact us at ieee-history@ieee.org.

GRANTS AND FELLOWSHIPS

PROGRAMS OF SUPPORT FROM THE IEEE HISTORY CENTER

The IEEE History Center offers two programs of support annually for scholars pursuing the history of electrical engineering and computing: An internship for an advanced undergraduate, graduate student, or recent Ph.D., and a dissertation fellowship for an advanced graduate student or recent Ph.D.

The internship and the dissertation fellowship are funded by the IEEE Life Members Committee. The internship requires residence at the IEEE History Center, on the Rutgers University Campus in New Brunswick, New Jersey, USA; there is no residency requirement for the dissertation fellowship.

IEEE LIFE MEMBER FELLOWSHIP IN ELECTRICAL HISTORY

The IEEE Fellowship in Electrical History supports 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 up to one year of post-doctoral research for a scholar in this field who has received his or her Ph.D. within the past three years. This award is supported by the IEEE Life Members Committee. The stipend is \$17,000, with a research budget of up to \$3,000.

Reimbursable research expenses include economy class travel to visit archives, libraries, historical sites, or academic conferences, either to hear papers or to present one's own work. Hotel stay, meals while travelling, copying costs, reprints of scholarly articles, and books directly pertaining to research are reimbursable. Any research trip expected to cost more than \$1000 must be approved in advance by IEEE History Center Staff. Examples of non-reimbursable expenses include, but are not limited to: licensing fees for images for book version of the-

sis (book publisher should pay for those), computers or computer peripherals, digital cameras, clothing, and office supplies (paper, pens, printer cartridges, CDs, memory sticks, etc.).

Recipients are normally expected to take up the Fellowship in the July of the year that it is awarded. Fellowship checks are normally mailed to the Fellow quarterly in July, October, January, and April. For Fellows in the southern hemisphere who follow the southern hemisphere academic year, arrangements can be made to mail the checks in December (two quarters worth), March, and June.

Candidates with undergraduate degrees in engineering, the sciences, or the humanities are eligible for the fellowship. For pre-doctoral applicants, however, the award is conditional upon acceptance of the candidate into an appropriate graduate program in history at a school of recognized standing. In addition, pre-doctoral recipients may not hold or subsequently receive other fellowships, but they may earn up

to \$5,000 for work that is directly related to their graduate studies. Pre-doctoral fellows must pursue full-time graduate work and evidence of satisfactory academic performance is required. These restrictions do not apply to post-doctoral applicants.

The Fellow is selected on the basis of the candidate's potential for pursuing research in, and contributing to, electrical history. Application forms are available on-line at http://www.ieee.org/web/aboutus/history_center/about/fellowship.html. The deadline for completed applications is 1

February 2011. This completed application packet should be sent to the Chair, IEEE Fellowship in Electrical History Committee, IEEE History Center, Rutgers, The State University of New Jersey, 39 Union Street, New Brunswick, NJ 08901-8538. Applicants will be notified of the results by 1 June 2011.

The IEEE Fellowship in Electrical Engineering History is administered by the IEEE History Committee and supported by the IEEE Life Members Committee.

IEEE HISTORY CENTER LIFE MEMBER INTERNSHIP

Scholars at the beginning of their career studying the history of electrical technology and computing are invited to contact the Center to be considered for a paid Internship at the Center's offices on the Rutgers University campus in New Brunswick, New Jersey.

The intern program seeks to provide research experience for graduate students in the history of electrical and computer technologies, while enlisting the help of promising young scholars for the Center's projects. The Intern generally works full-time for two months at the History Center on a Center project that is connected to his or her own area of interest. This time is usually during the summer, but other arrangements will be considered. Interns are also encouraged to consult with the Center's staff and its associates, and guided to research resources in the area. The internship is designed for those at the beginning or middle of their graduate careers, but advanced undergraduates, advanced graduates, and, on rare occasions, recent Ph.D.s will also be considered. Special consideration is often given to scholars from outside the United States who might not otherwise have an opportunity to visit historical resources in this country.

The stipend paid to the intern is US\$3,500, but additional funds may be available to defray travel costs, depending on the intern's circumstances. This internship is supported by the IEEE Life Members Committee.

There is no formal application form. To apply, please mail a curriculum vitae showing your studies in electrical history along with a cover letter describing the sort of project you would be interested in doing (see contact information below). The deadline for contacting the IEEE History Center is 1 March 2011.

IEEE and Rutgers are AA/EO employers. Women and minorities are encouraged to apply for all positions. The IEEE History Center is cosponsored by the Institute of Electrical and Electronics Engineers, Inc. (IEEE)—the world's largest professional technical society—and Rutgers—the State University of New Jersey. The mission of the Center is to preserve, research, and promote the legacy of electrical engineering and computing. The Center can be contacted at: IEEE History Center, Rutgers University, 39 Union Street, New Brunswick, NJ 08901-8538, ieee-history@ieee.org, http://www.ieee.org/web/aboutus/history_center/index.html

BAKKEN TRAVEL GRANTS

Scholars and artists are invited to apply for travel fellowships and grants, which the Bakken Library and Museum in Minneapolis offers to encourage research in its collection of books, journals, manuscripts, prints, and instruments. The awards are to be used to help defray the expenses of travel, subsistence, and other direct costs of conducting research at the Bakken for researchers who must travel some distance and pay for temporary housing in the Twin Cities in order to conduct research at the Bakken.

1. **Visiting Research Fellowships** are awarded up to a maximum of \$1,500; the minimum period of residence is two weeks, and preference is given to researchers who are interested in collaborating informally for a day or two with Bakken staff during their research visit.

2. **Research Travel Grants** are awarded up to a maximum of \$500 (domestic) and \$750 (foreign); the minimum period of residence is one week.

The next application deadline for either type of research assistance is **February 11, 2011**.

For more details and application guidelines, please contact:

Elizabeth Ihrig, Librarian
The Bakken Library and Museum
3537 Zenith Avenue So.
Minneapolis, MN., 55416
tel 612-926-3878 ext. 227
fax (612) 927-7265
e-mail Ihrig@thebakken.org
www.thebakken.org

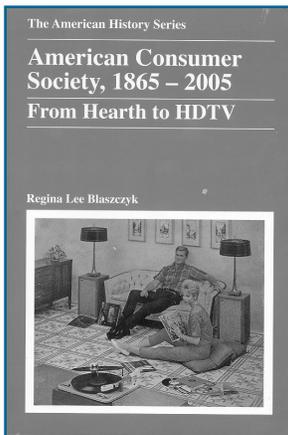


Sections of two-conductor and three-conductor transmission cables from Edison's Pearl Street Generating Station. These cables were dug up recently from under the streets of lower Manhattan.

Photo courtesy of Carl Sulzberger

BIBLIOGRAPHY

BLASZCZYK, REGINA LEE,
American Consumer Society, 1865-2005: From Hearth to HDTV, Harlan-Davidson, Wheeling, 2009



Sometimes, the best way to gain an understanding of a broad historical topic is with a book written by a known authority in a subject, but written broadly for use in a college course. Blaszczyk, an award-winning business historian known for her scholarly monograph *Imagining Consumers: Design and Innovation from Wedgwood to Corning* (2002), and her edited volume *Producing Fashion: Commerce, Culture, and Consumers* (2007) is the ideal author to write a survey of American consumer society for students and

others, and she succeeds admirably.

Blaszczyk divides her book into three chronological parts: Victorian America 1865-1900, characterized by birth of the first mass consumer society, the rise of mass merchandisers and consumer advertising to teach people what to buy, and "Victorian preciousness" including people collecting and displaying possessions in their homes; Modern America 1900-1945, where mainstream culture became fast-paced, technologically savvy, and always changing, geared towards immediate satisfaction; and Boomer America 1945-2005, where America became the world's most affluent society, albeit one with heterogeneous tastes as the trappings of consumer culture became available to most people, and the focus of consumer culture evolved from possessions to experiences (or alternatively, from hardware to software.)

While much of her narrative, of course, deals with areas at best tangential to IEEE's fields of interests including clothing, furniture, housing and shopping, there is much to show the central role that electrical technologies have played in the shaping of American consumer society. These themes play out particularly in Chapter 5 "Sensing a Wider World" in part two and Chapter 9 "Electronics are Us" in part three.

The theme of "Sensing the Wider World" is the beginning of America's love affair with technologies that altered time, sound, light and distance. After discussions of bicycles, cameras, and phonographs, it soon moves on to a fine discussion of radio in American culture both, the large role radio broadcasting played in the 1920s and 1930s, and the less widespread but also important role of ham radio as a hobby. It then refocuses on the electrification of American households (by 1930 68% of which had electricity), and how the electrical industry successfully looked to consumers as a new market for not only electric lighting but electric appliances as well, in a successful effort to not only increase markets, but balance the load throughout the day. And finally, she notes one crucial distinguishing factor of electrical technologies: radios, appliances and telephones were part of complex technological systems, to which consumers became inexorably linked.

In "Electronics are Us" the focus is on consumer electronics in entertainment, beginning in 1948, which Blaszczyk calls the "year of consumer electronics" for things like the introduction of the LP record and the Ampex tape recorder, the invention of the transistor and the spread of TV. She covers, roughly chronologically, a range of household entertainment technologies, and how they were incorporated into and effected American consumer culture—television, transistor radios, hi-fi, tape cassettes, video games, personal computers before the internet (which she notes were more appliances than sources of entertainment,)the internet, cable TV, and finally the iPod, which she notes effectively represented the convergence of what had been the many separate strands of the consumer electronics revolution. American consumer society had evolved not only from analog to digital, but from material things to meaningful experiences; from hardware to software; from hearth to HDTV.

By the book's end, she has well proven her contention that there is no better lens to examine what it means to be an American than the lens of American consumer culture. (And that is a culture in which electrotechnologies have played a larger part.)

Available from Harlan-Davidson, Inc., Wheeling, Illinois, USA. (847) 541-9720. Fax: (847) 541-9830. <http://www.harlandavidson.com/> \$24.95. ISBN-13 978-0-88295-264-2 384 pp., index.

JANE BROX,
Brilliant: The Evolution of Artificial Light, Houghton
Mifflin Harcourt, Boston, 2010

Raynor Banham, a distinguished historian of architecture, described the rise of electrical technology as “the greatest environmental revolution in human history since the domestication of fire”. Central to this revolution was the role of electric lighting in reshaping life in the home, workplace and in the city. Few citizens, if any, from the world’s more developed economies can conceive of life without artificial lighting. Few of us can imagine that before the 18th century, in the absence of a full moon, complete darkness invaded human existence each evening after the setting of the sun. In her book “*Brilliant: The Evolution of Artificial Light*”, Jane Brox offers an absorbing account of humanity’s efforts to illuminate the night. In the first half of the book, Brox sets the context for Banham’s revolution: electrical technology. For millennia, fire was the only source of artificial lighting. It was less than 150 years ago when electricity broke this dependence. From the dim light of candles, oil lamps and gas lighting, electrical technology, within only another 100 years, filled all the dark corners of the night with brilliant light.

Brox’s well written story of artificial lighting divides into two parts: fire and electricity. The part dealing with lighting before the advent of electricity is, perhaps, the most intriguing because it gives us a glimpse of a time when darkness ruled the night. Starting with prehistoric humans, working her way up to the ancient world, the Medieval world, and then into the 17th century, Brox gives us a sense of what it was like to live in towns after the sun had set. In Imperial Rome, according to Cicero, “night fell over the city like the shadow of a great danger....Everyone fled to his home, shut himself in, and barricaded the entrance. The shops fell silent, safety chains were drawn across behind the leaves of the doors.” A thousand years later, the world with the world still without any lighting in the streets, only rodents, thieves, vandals went out at night. Concerned with the dangers of the night, a 1380 a decree in Paris ordered that “all houses are ... to be locked and the keys deposited with the magistrate.” In the home, for those who could afford them, candles provided lighting. Most candles were made of tallow. These candles threw off a very dim light, which got dimmer as the candle burned. Keeping these candles lit was a problem. They also gave off a foul odor. Beeswax candles produced a cleaner and slightly brighter light but their high cost put them out of the reach of all except the very rich and the nobility.

Progress, as Brox explains, in the use of fire for lighting arose from the development of cleaner, brighter, longer lasting, cheaper, and more reliable flames. Key to this progress were the discoveries of better combustible materials, an understanding of the science of fire, and more convenient ways to ignite fuel. The first big step forward came with whale oil. Whale oil lamps produced a more reliable, brighter and cleaner flame. The oil from sperm whales produced the best flames. The sperm whale also provided the highly prized spermaceti, a waxy substance contained in its head. Spermaceti produced a truly superior candle. One sperm whale could yield from 500 to 900 gallons of spermaceti. As Brox so well illustrates, the growth of worldwide whaling in-

dustry and the incredible multiplication of candles and lamps in the home and workplace were inextricably tied to each other. The demand for a better flame launched the countless whalers from the shores of New England and other ports around the world. The greater luminosity and efficiency of these lamps resulted from a revolution in the science of combustion. Joseph Priestly’s and Antoine Lavoisier’s work demonstrated that oxygen fueled flames. This scientific breakthrough led the Swiss scientist Francois-Pierre Ami Argan to design a radically new wick that allowed the lamp flame to burn at much higher temperatures. The results were cleaner, more efficient, and brighter flames. Artificial lighting driven by whale oil reached its peak in the 1860s but a new technology would dramatically expand the capabilities of fire-based illumination.

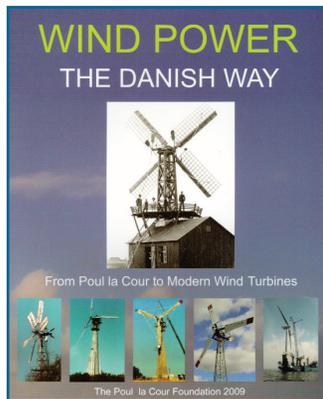
Gas lighting altered the technology, economics and business of lighting. In luminosity, reliability, and convenience, gas lighting greatly surpassed oil lamps and candles. The one downside was the ever present danger of poisoning if the flame went out in enclosed spaces. Gas considerably increased the quality and convenience of illumination in the work place and in the streets. Rather than having a countless number of local fuel sources, the advent of gas lighting gave rise to large utilities that could produce the gas in a few centralized locations and then distribute the gas to a large geographic area through a network of pipes. These networks for transmitting service to a larger number of distributed individual subscribers represented new technological and organizational models. The gas lighting networks set the stage for the electrical power networks that followed.

Coal was essential to gas lighting. The gas came from roasting coal in the production of coke, which was also critical to steel making. Increasing the production of coal required better illumination of mines. Flames and coal mines were a dangerous combination. Fine coal dust and methane, often found in these mines are highly explosive. How could one turn on a light without igniting a deadly explosion? Brox gives us the answer - Humphrey Davy’s invention, in 1815, of the miner’s lamp, or Davy lamp. You will have to read Brox’s book to learn how Davy’s invention kept the lamp flame from igniting the explosive coal dust and methane. Davy is the same man who, seven years earlier in 1808, produced the first source of light from electrical energy. Among other things, Davy was pioneer in electrochemistry. Using very powerful batteries that he developed, Davy was the first to isolate elements like sodium, potassium, barium and others. These powerful batteries also allowed Davy to discover the arc light - the first artificial light that did not depend on a flame. His discovery became the talk of the town. To all who saw it, this dazzling light was indeed wondrous. It would take a few decades and the development of electric generators before his discovery became a useful source of illumination. But once it did, progress in electric lighting was, as Brox explains, remarkably fast; arc lighting, incandescent light, fluorescent light, and LEDs - all within 150 years. Even more important, as her narrative reveals, electric lighting has profoundly transformed people’s relationship to the night.

Available from Houghton Mifflin Harcourt, Boston, New York, ISBN-13: 978-0547055275 <http://www.hmhco.com>

CHRISTENSEN, BENNY, editor
Wind Power – The Danish Way; From Poul la Cour to Modern Wind Turbines, The Poul la Cour Foundation, 2009

Guest book review by Dr. Dimitri R. Stein



This book should appeal to readers interested in the history and the development of wind power for electricity production, and particularly in the Danish example.

Starting with a review of the early development of wind power by Poul la Cour (1846 – 1908), an inventor, mathematics teacher, and mechanical genius, the book reviews the growth of the industry. La Cour built the first electricity-producing wind power plant in

Denmark in 1891. The plant used an historic Dutch windmill design with a four-bladed rotor incorporating sophisticated mechanical controls that anticipated many subsequent developments. Use of wind power in Denmark peaked in the years prior to and including World War I, the “Golden Age” of wind power, because of the cost and unavailability of fuel for diesel engines that were widely used to power agricultural machinery. The Danish Wind Electricity Association, organized in 1903, listed 132 small wind power plants then in operation. In 1910, more than ten firms produced so-called “wind-motors,” of which the Lykkeguard Company supplied the largest part. These plants produced direct current (dc) with an average output of 60,000 to 70,000 kWh each year.

At the beginning of World War II, a major Danish industrial firm, F.L. Smith & Company, introduced a novel wind power plant with two or three blades designed on modern aerodynamic principles. These stations with rotor diameters of 17.5 m (57.4 ft) and 24 m (78.7 ft) were equipped with 50 or 70 kW generators. The three-bladed models produced between 90,000 and 135,000 kWh per year.

The F. L. Smith & Company stations generated alternating current (ac), thus making it possible for the plants to operate in parallel with the utility network. The book relates a particularly interesting detail, namely that development work after World War II was made possible through Marshall Plan financial support.

The reviewer of this book had the opportunity in September 1941 to study the Danish wind power plants which were then in operation. The results of his findings were published in 1942 in the German Journal “Elektrizitaetswirtschaft.” Later, in a 1951 issue of the same publication, the reviewer analyzed the operating modes and the actual energy outputs for the years 1941 to 1944 of 64 Danish wind power plants that had reported their data to the Association of Danish Rural Electricity Plants.

Another factor greatly facilitated the development of wind power in Denmark. All patents and design details were shared by all manufacturers. Also, the government provided generous subsidies. This resulted in a strong development of new wind power plant designs by several major manufacturers. Perhaps the most successful firm was the Vestas Company, which to today is the

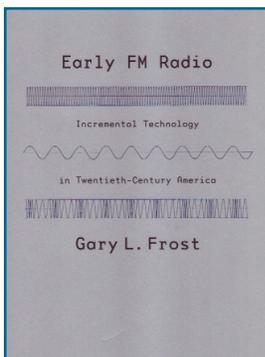
leading supplier of modern wind power plants worldwide. In the years 1982 to 1985, Vestas and other Danish manufacturers supplied hundreds of modern wind power plants to the United States, most of which were installed in California. In fact, 90 percent of Danish wind turbine production was exported to the United States in those years.

Denmark was a pioneer in the early development of wind power for electric energy production and is today one of the leaders in the design and manufacture of wind turbine units and in the actual use of wind power to produce electricity for Danish industrial, commercial, and residential utilization. This book, “Wind Power – The Danish Way,” is an interesting and informative account of the long history of wind power in Denmark. Its 88 pages include many vintage and modern photographs and illustrations that effectively supplement the text.

Available from The Poul la Cour Foundation, Møllevej 21, Askov, DK-6600 Vejen, Denmark; <http://www.poullacour.dk>, € 35, including VAT and shipping cost, soft cover, ISBN 978-87-993188-0-3, ten chapters, 88 pp.

FROST, GARY L.

Early FM Radio: Incremental Technology in Twentieth-Century America, John Hopkins University Press, 2010



Gary Frost's *Early FM Radio* offers a new perspective on the development of FM radio. The usual view is that Edwin Armstrong, almost single-handedly, brought this technology to fruition. Frost shows that many people contributed to its development and sheds new light on Armstrong's relation to RCA. In 1990 the law firm that represented Armstrong in his long legal battles with RCA donated the Armstrong files to Columbia University, and Frost has made extensive use of

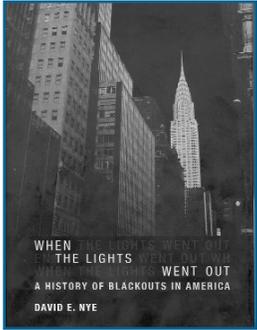
these records in revising the standard account of FM history.

Frost examines the contributions of radio engineers, at RCA, Westinghouse, and elsewhere, from the first decade of the century into the 1940s. He considers, as well, the important role of radio amateurs and the pioneers of FM broadcasting. A concluding chapter provides an overview of how FM has fared in the years since 1940. Though a lay person would understand most all of the book, the technical level is fairly high, as many equations and circuits are presented and explained.

Gary Frost is an engineer and freelance historian. This book is carefully researched, and sources are given in endnotes. There is also an essay on sources and a glossary of technical terms. About two dozen figures, many of them circuit diagrams, complement the text. An appendix gives the basic information about FM-related patents issued in the United States from 1905 to 1953.

Available from John Hopkins University Press, 2715 North Charles Street, Baltimore, MD 21218-4363; <http://www.press.jhu.edu> cloth \$60.00, ISBN 978-0-8018-9440-4, xi + 191 pp.

NYE, DAVID,
When the Lights Went Out, MIT Press, 2010



David Nye, the author of *Electrifying America* and *Consuming Power*, has written an engaging history of the opposite side of electrical history, namely what happens when the electricity goes off and there is no power to consume. *When the Lights Went Out* explores how the public reaction to blackouts has changed and how the festive mood in New York City during the 1965 blackout was significantly different from the eruption of arson and looting during the 1977 blackout.

Nye describes how electricity – by banishing darkness – altered time. Thus, as power systems became more complex and thus subject to blackouts, “artificial darkness” (which is really not ‘artificial’ at all, but a return to the natural state) became the new anomaly. Cities became anti-landscapes, uninhabitable without electricity. Nye examines the social reactions to the controlled

blackouts instituted during World War II, the coal shortage brownouts of 1946 caused by the strikes, and the accidental blackouts of 1965, 1977, and 2003, and the rolling blackouts of the 1980s and 1990s.

Nye examines how the economic forces in the deregulated electric utility industry fostered the development of interconnections, which have increased the complexity of the systems which need to be monitored and maintained, and which make large failures possible.

The final chapter “Greenout?” makes a plea for voluntarily reducing our use of electricity. The effects on the environment – global warming, acid rain, strip mining – are cited, but Nye also points out the advantages to our sensory balance and reduction of stress to reduce our dependence on electricity. Nye notes that the U.S. economy loses an estimated \$50 billion per year as a result of power failures, and points out that – as the power consumption demands on the grid increase, and the generation and delivery systems become more complex – those failures will continue.

Available from The MIT Press, Cambridge, MA, 800-358-0343, fax: +1 617-625-6660 <http://mitpress.mit.edu>, \$27.95, hard, ISBN-978-0-262-01374-1, 292 pp., 26 illus., index

DONORS AND SPONSORS

DONOR PROFILE – DR. JOHN IMPAGLIAZZO



Director of Development Michael Deering (left) recently hosted John at the IEEE Operations Center to thank him for his generous support and present his IEEE Goldsmith Legacy League and IEEE Heritage Circle custom binders, coins and certificates of membership.

Dr. John Impagliazzo, a Professor and the ictQatar Endowed Chair of Computer Science at Qatar University, has a passion for the history of computing. A recent IEEE Life Fellow, his enthusiasm encompasses his professional life, volunteer activities and philanthropic spirit. He is the recipient of the IEEE Computer Society Outstanding Contribution Award (2005) for his work on the Computer Engineering Report. John has served as a member of the IEEE History Committee as its Treasurer, and chair of its Finance and Strategic Planning subcommittees. John is also an Honored Philanthropist of the IEEE Foundation.

According to John, his financial gifts to the IEEE History Center through the IEEE Foundation History Center Fund are an expression of his appreciation for the work being conducted to archive and preserve histories of information processing, inventions, practices and proper documentation of the contributions made by pioneers in this field. His website, www.CompHist.org is an expression of his enthusiasm for computing history.

John is now a member of the elite group of *Forever Generous* donors since informing the IEEE Foundation Development office of his intention to leave a legacy gift to the IEEE Foundation. His generosity and ongoing commitment through the years also makes him an *Honored Philanthropist* and member of the IEEE Heritage Circle. Senior Manager of IEEE Foundation Operations and Planned Giving, Karen Galuchie, and

Director of Development Michael Deering recently hosted John at the IEEE Operations Center. They thanked him for his generous support of the IEEE Foundation and presented him with both his IEEE Goldsmith Legacy League and IEEE Heritage Circle custom binders with the respective commemorative coins and certificates of membership.

Along with Michael Deering, John initiated, promoted, and worked on the cumulative giving donor recognition concept back in 2008 to honor the ongoing commitment of donors to the IEEE Foundation. He is quite pleased with the outcome of the **IEEE Heritage Circle** program which was launched in 2009.

All long-standing supporters whose donations to IEEE Foundation total US\$10,000 since 1 January 1995 will be automatically recognized as an *Honored Philanthropist* and a member of the **IEEE Heritage Circle**. Qualifying donations include gifts of: cash, stock, gifts of cash prizes, pledge payments, gifts of royalties and donor advised gifts.

The IEEE Heritage Circle contains five giving levels named after great innovators who helped shape the world in which we live.

Nikola Tesla	\$10,000 - \$49,999
Alexander Graham Bell	\$50,000 - \$99,999
Thomas Alva Edison	\$100,000 - \$249,999
James Clerk Maxwell	\$250,000 - \$499,999
Michael Faraday	\$500,000+

Visit IEEE Foundation, call 732 562 5550 or e-mail the IEEE Development Office to learn more about the IEEE Heritage Circle. The IEEE Development Office can provide information regarding the status of your cumulative giving and alert you when milestones are reached in the hierarchy of the IEEE Heritage Circle.

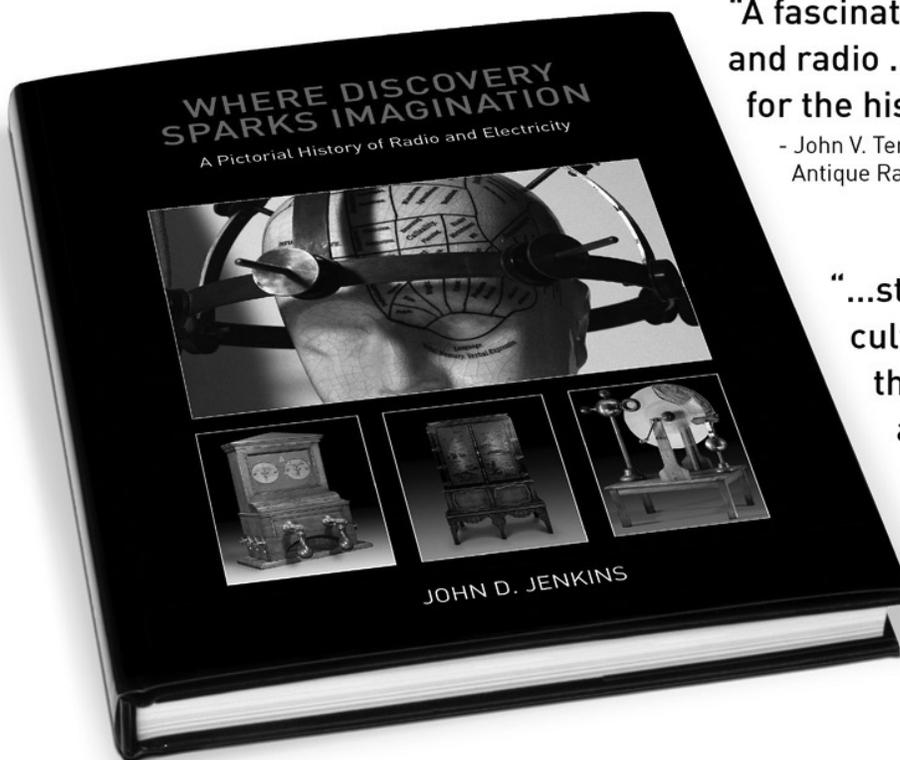
Donations may be made online and you may specify your gift for the IEEE History Center Fund. Thank you in advance for supporting the IEEE History Center and the history of the profession with your donation to the IEEE Foundation during dues renewal or anytime throughout the year.

“A fascinating pictorial, the unfolding of the bizarre and the beautiful,... that will delight the senses and excite wonder.”

- Robert J. Malone, Ph.D., Executive Director,
The History of Science Society

“If Ben Franklin were alive today, he would have a field day exploring this book — a veritable garden of electrical delights.”

- David J. Rhees, Ph.D., Executive Director,
The Bakken Museum



“A fascinating history of electricity and radio ... an invaluable reference for the historian and collector.”

- John V. Terry, Publisher and Editor,
Antique Radio Classified

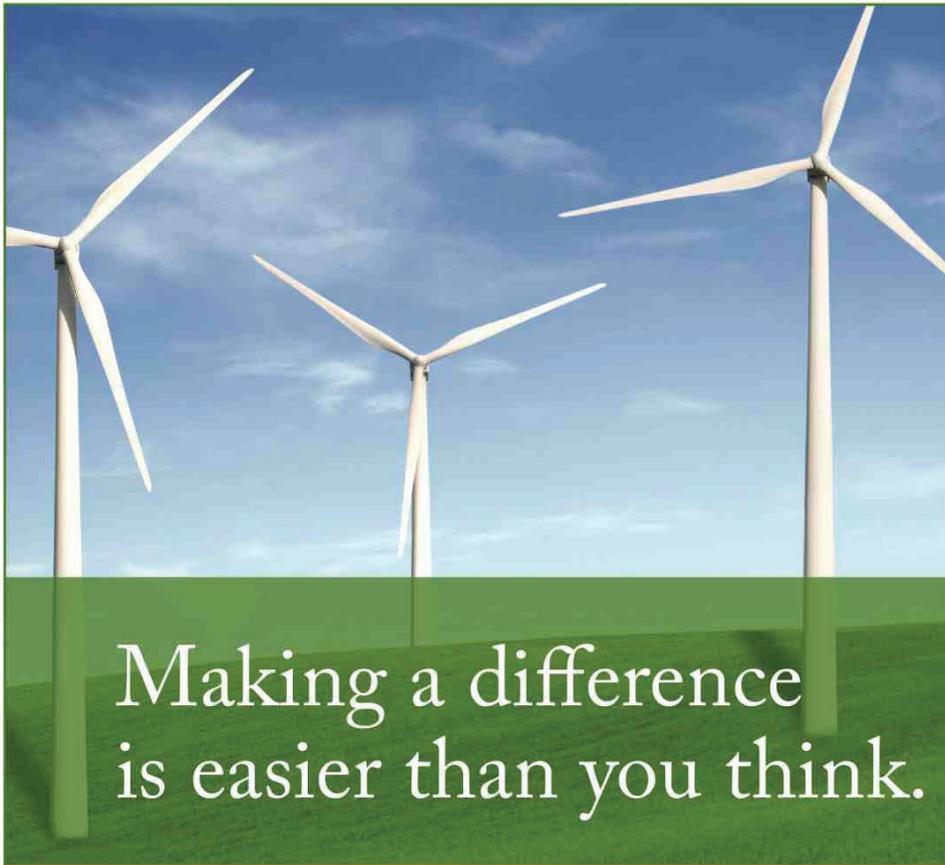
“...stories about both the cultural transformations that radio made possible, and the science of electricity itself. A thoroughly worthwhile book.”

- Steven Turner, Curator,
Smithsonian Institution

The early history of electricity and radio, presented via a marvelous collection of over 600 stunning photographs of actual apparatus, many of which have never before been published.

Anyone who appreciates the amazing workmanship and artistry of old technology will love this book!

NOW AVAILABLE AT WWW.WDSI.US, AMAZON.COM AND OTHER BOOKSELLERS NATIONWIDE



Making a difference
is easier than you think.

IEEE History Center Fund

The IEEE History Center Fund is one of the 125+ funds administered by the IEEE Foundation. It relies on charitable donations to sustain and expand its mission to preserve, research and promote the heritage of electrical and information technologies and sciences. Visit www.ieee.org/history_center

The IEEE Foundation provides resources to advance education, innovation and preservation. Together we can discover new solutions, recognize technology pioneers and honor the legacy of IEEE. Make a gift and show your commitment to technology and humanity. **Imagine the difference you can make.**

Donate today at www.ieeefoundation.org



IEEE History Center
Institute of Electrical and Electronics Engineers
445 Hoes Lane, P.O. Box 1331
Piscataway, NJ USA 08855-1331



Making a *safe and secure*
online gift to the
IEEE Foundation – History Center Fund
has never been easier!
Please register now by clicking
the “Donate Online” tab at
www.ieeefoundation.org