IEEE

IEEE History Center

Dr. Abbate, acclaimed historian of technology and the author of Recoding Gender: Women's Changing Participation in Computing *and* Inventing the Internet *giving a lecture hosted by the IEEE History Center*

RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

STATIC FROM THE DIRECTOR

By Michael Geselowitz, Ph.D.

In much of the world, August marks the leisure travel season. There may be a public perception that transportation falls within the realm of civil engineering. When earlier this year the American Society of Civil Engineers (ASCE) handed out its highly publicized, quadrennial "report card" on the infrastructure of the U.S.A., seven of the 16 categories involved transportation. However, anyone who pays attention to media reports of technological innovation will notice a steady and growing convergence between transportation and fields traditionally covered by electrical and electronics engineers. Electronically self-driving vehicles are poised for emergence as a legitimate product even as electrically powered vehicles are becoming a major industry. Magnetic levitation train technology continues to advance. South Korea is about to open the third operational line at Incheon Airport. While technically the second commercial line, it may be the first time the technological choice stood on its own, not shaped by politics.

These developments come as no surprise to the historians of the IEEE History Center. In the early days of engineering as a modern profession, the lines between the disciplines were not so neatly drawn. Thomas Edison, the iconic late 19th century inventor/entrepreneur who helped found the American Institute of

SUBSCRIPTION INFORMATION

The IEEE History Center newsletter is available free to all persons interested in technological history – whether engineers, scholars, researchers, hobbyists, or interested members of the public. It is published in hard copy in March, and in electronic form in July and November of each year.

To subscribe to the IEEE History Center's free newsletter, please send your name, postal mailing address, e-mail address (optional if you wish to receive the electronic versions), and IEEE member number (if applicable – non-members are encouraged to subscribe as well) to **ieee-history@ieee.org**

Current and past issues of the newsletter can be accessed at: **www.ieee.org/about/history_center/newsletters.html**

The IEEE History Center is a non-profit organization which relies on your support to preserve, research, and promote the legacy of electrical engineering and computing. To support the Center's projects – such as the Global History Network, Milestones, and Oral History Collection, please click the "Donate Online" tab at **www.ieee.org/donate** or **www.ieeefoundation.org/**

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 (in situ and still operating is of particular interest). Length: 500-1200 words. Submit to **ieee-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.

	Cost Per Issue
Quarter Page	$150
Half Page	$200
Full Page	$250

Please submit camera-ready copy via mail or email attachment to **ieee-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**.

Electrical Engineers (AIEE, predecessor to IEEE), worked on the mechanical phonograph, electric power and light, and the production of Portland cement. It is appropriate (ironic?) in the 21st century that so many different fields of engineering are converging in order better to advance technology for humanity. These developments are in part why the IEEE is in conversation with ASCE and other sister societies about closer cooperation in history (see page 5).

As for the early role of electrical engineering in transportation specifically, one need look no further that this issue with its archival feature on Steinmetz's electric car (see page 4).

Therefore, dear reader, if you will be traveling soon by land, sea or air, *bon voyage* from the IEEE History Center.

CENTER ACTIVITIES

HEAVISIDE/MAXWELL EQUATIONS ARTICLE SETS READERSHIP RECORD IN *THE INSTITUTE*

An article by IEEE History Center Senior Staff Director Dr. Michael Geselowitz drew more than 27,700 readers, the highest views ever for an Institute article. The article, "Did You Know? Someone Else Wrote Maxwell's Equations" **http://theinstitute.ieee.org/technology-focus/technology-history/did-you-know-someone-else-wrote-maxwells-equations** describes the important work done by Oliver Heaviside to sim-
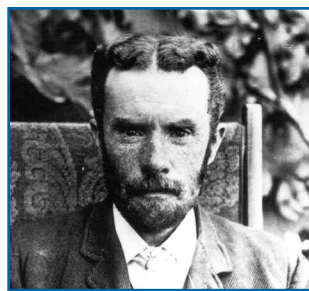
Oliver Heaviside, who put Maxwell's equations in the form we know them.

plify the equations using notation that would be clearer to use. The article is part of a continuing collaboration between the IEEE History Center and *The Institute* to bring the history of IEEE's fields of interest alive for the members. Look for future articles on the history of hearing aids, tornado and tsunami detection devices, and secret White House recordings (which began long before Nixon) at **http://theinstitute.ieee.org**

HISTORY CENTER HOSTS COMPUTER HISTORIAN JANET ABBATE

On April 3rd the IEEE History Center and the Rutgers Institute for Research on Women hosted a talk by Janet Abbate, Associate Professor of Science and Technology at Virginia Tech. Abbate is an acclaimed historian of technology and the author of *Recoding Gender: Women's Changing Participation in Computing* (MIT Press, 2012) and *Inventing the Internet* (MIT Press, 1999).

In her talk entitled, "Gender and the History of Computing," Abbate presented work from her current research. She described women's experiences in programming and computer science from the 1940s to the late 20th century. The research draws on oral history interviews with more than fifty women who were active in computer science departments and the software industry in the United States and Great Britain. Abbate recorded their astounding stories, the structural and institutional challenges they faced as they strived to advance in their workplace, and their eventual marginalization. She mentioned, for example, how the lack of a ladies' bathroom at major companies made women feel unwelcome. Some were resourceful enough to result to whistling while using the men's room to warn their colleagues of their presence.

Abbate described how programming—that for a period of time after World War II was considered "women's work"—be-

came masculinized; so much so that women today earn a relatively low percentage of computer science degrees and hold proportionately few technical computing jobs with percentages that have declined since the 1980s. Abbate is confident that the computer industry would benefit if it would encourage both men and women to exercise the full range of human interests and abilities.

Abbate's talk brought together scholars from various fields such as history, physics, sociology and gender studies, and initiated a lively discussion of the questions and issues it raised. The lecture was preceded by lunch with graduate students from the history department who work in the nexus of culture and technology. It was also attended by the stuff of the IEEE history center who had organized it, and that had met Abbate as a post-doctoral fellow at the center more than a decade ago. Abbate was excited to be back at the IEEE. She has generously provided the oral histories she conducted for the book to the IEEE History Center, and the Center has made them available to the public. The full versions of all the oral histories can be found at: **http://www.ieeeghn.org/wiki/index.php/Oral-History:Women_in_Computing**

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IEEE HISTORY CENTER SOCIAL NETWORKING ON TWITTER AND TUMBLR

The IEEE History Center is bringing history to more people via social networking tools such as Twitter and Tumblr. Follow the activities of the IEEE History Center and others involved in the history of engineering on its Twitter feed at **https://twitter.com/ieeehistory**.

The IEEE History Center has launched a blog on Tumblr in which interesting images related to the history of technology are posted. Featured in Tumblr's history and science categories, the blog has approximately 20,000 followers as of June, 2013 and and more than 700 social interactions. To follow the blog or to view the images, go to **http://engineeringhistory.tumblr.com/**.

CHARLES STEINMETZ ON THE ELECTRIC CAR: A TREASURE FROM THE IEEE ARCHIVES

Most of the material in the IEEE Archives are official Institute records—documents, images, and artifacts that preserve the history of IEEE and its predecessors AIEE and IRE. The Archives' mission is Institutional history.

Beyond this mission, there is a small quantity of material of a broader nature, dealing with one aspect or another of IEEE's technologies. One of the most interesting such documents is a signed, unpublished March 1920 typescript by Charles Proteus Steinmetz on electric cars.

Charles Steinmetz was one of the most prominent early members of the AIEE, serving as Institute President in 1901-1902. Steinmetz spent his career with General Electric, for many years as GE's chief consulting engineer, based in Schenectady, New York, U.S.A. He did research and wrote, chiefly fundamental work on electrical theory and related mathematical analysis. His work included the law of hysteresis, mathematical methods for calculating AC phenomena, and several books: most notably *Theory and Calculations of Transient Phenomena and Oscillations* (1909). Alongside his GE work, he spent twenty years as a part-time faculty member at nearby Union College .

Although electric cars had been competitive with internal-combustion vehicles in the U.S. in the first decade of the twentieth century, they declined rapidly in the 1910s, as gasoline-powered cars improved. The latter's decreasing price, greater range and faster speeds, combined with a decrease in the price of oil, made them the standard as cars evolved from novelties for the rich towards technology used by a broad range of Americans.

In the manuscript, Steinmetz listed what he saw as the relative advantages of gasoline and electric cars. He contended that electric cars and trucks could be manufactured that would be fully competitive for urban use, and proposed a novel design to accomplish this goal. His design featured a novel compact double-rotor motor that was an integral part of the rear axle. It thereby did away with the need for a mechanical differential and drive shaft, reducing weight and complexity.

A small number of cars with Steinmetz's double-rotor motor had already been manufactured in 1917 by the Day Electric Corporation, but they were a commercial failure. Steinmetz helped form the Steinmetz Electric Car Company in 1920 to produce electric cars, but the company built only a few prototypes before ceasing operation shortly after Steinmetz's death in 1923.

The complete typescript can be viewed on the IEEE Global History Network. A longer discussion of Steinmetz's manuscript, with an easy-to-read version of the text can be found in: C. Sulzberger, "Steinmetz's Electric Car," *IEEE Power and Energy Magazine*, Volume 3 Number 5 (September-October 2005) 70-77.
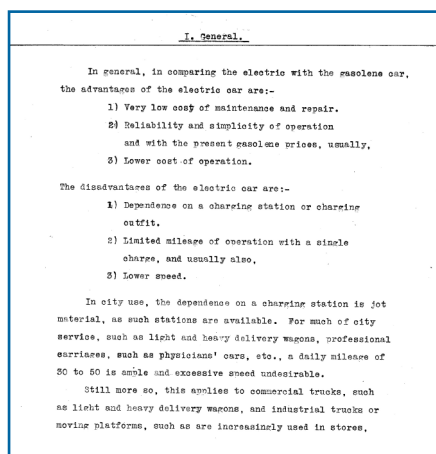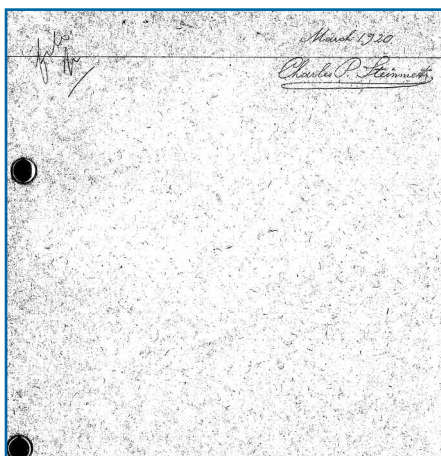
The signature and first page of Steinmetz's manuscript on electric cars.

IEEE HOLDS WORKSHOP WITH SISTER SOCIETIES ON WEB COLLABORATION IN ENGINEERING HISTORY

The National Academy of Engineering has determined that engineers need to be involved in "Changing the Conversation" about engineering, that is, raising public awareness of the important role engineering has in society and to correct public misconceptions of engineering. It is hoped that the result will be to enhance the image of the engineer in order to elevate the prestige of the profession and attract the best and brightest young people to its ranks, and to improve technological literacy among the citizens of an increasingly technologically-based society. As the existence of the IEEE History Center demonstrates, IEEE (the Institute of Electrical and Electronics Engineers) has long recognized the role that history can play in this conversation. It turns out that so do, to varying extents, IEEE's fellow "Founder Societies", the American Institute of Chemical Engineers (AIChE), the American Institute of Mining Engineers (AIME), the American Society of Civil Engineers, and the American Society of Mechanical Engineers (ASME). However, IEEE is more advanced than the other societies in its historical efforts, particularly in its web efforts through the IEEE Global History Network (GHN; **http://www.ieeeghn.org**).

IEEE obtained funding from the United Engineering Foundation (UEF) to hold a workshop to explore whether a common, united site dedicated to the history of all disciplines of engineering and the contribution of engineering achievements to mankind, might be an extremely effective tool for raising the general public's awareness of engineering, while simultaneously advancing the role that history plays within each organization. Such a website would convey a powerful message: Engineering is fundamental to who we are as human beings.

The workshop, hosted by the IEEE History Center at the IEEE Operations Center, IEEE, brought together seventeen volunteer and staff representatives of the Founder Societies plus the Society of Petroleum Engineers (SPE, one of the member societies of AIME), and the Society of Women Engineers (SWE). Dennis Martenson, President of UEF also attended. There was strong agreement among the participants that this was powerful idea to be actively explored. Look for more exciting developments to be reported in future issues of the IEEE History Center Newsletter.

GHN UPDATE

The IEEE Archives houses a number of ¼" reel-to-reel audio tapes which were previously unavailable online. The History Center obtained a ¼" reel player (pictured right) and since March has been digitizing, remastering, and posting these tapes to the GHN.

Approximately forty reels in total have been digitized, most of which are sessions from the IEEE 1969 International Convention and Exhibition. A number of fascinating panels, including "Living in Working in Space", chaired by Wernher von Braun, and "Communications and the Computer", featuring Gerald Estrin and Robert Lucky were recorded in their entirety. Most of the programs not part of the 1969 conference are other technical lectures, such "Our Environment - Options on the Way and to the Future", "Credibility and the Public Trust" and "Microelectronics Comes of Age - Systems of the Future".

In addition to these technical talks, a variety of other programs were recorded. A conversation between two IRE Past Presidents, Alfred N. Goldsmith and John V.L. Hogan, entitled "From Acorn to Oak", details the history of the IRE from its beginnings to the 1950s, and a celebratory program recorded on Armistice Day, November 11th, 1936, featuring David Sarnoff and Guglielmo Marconi are now available online.

These audio programs, as well as tapes posted previously, can be heard in their entirety on the GHN in the archival audio collections, hosted at:
http://www.ieeeghn.org/wiki/index.php/Archives:Audio

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

IEEE Global History Network
www.ieeeghn.org

PRESERVE YOUR COLLEAGUES' ACHIEVEMENTS: ORAL HISTORY TRAINING WEBINARS

There are more IEEE members with stories and career recollections worth preserving than the History Center Staff could ever hope to record. There are two ways the History Center has developed to capture these memories. One is the **"First Hand Histories"** section of the IEEE Global History Network (GHN), where any member can write and post his or own story. More than one hundred and fifty members have already done so. We invite you to add your recollections.

The second method is to encourage IEEE organizational units to record and transcribe oral history interviews of their prominent members and then send the completed transcripts to the History Center for posting. Regions 3 and 8 and the IEEE Computer Society are among the organizational units that have already done so, adding to **the collection of more than 575 oral histories** available on the GHN.

But there is much more involved in a successful oral history than just putting a microphone in front of somebody and asking them to talk about their life. There are certain easily-learned skills of preparation and topic development, and simple but crucial legal requirements. Sheldon Hochheiser, the IEEE History Center staff member in charge of oral history, has long given occasional training sessions to groups of IEEE members interested in doing oral history.

To increase the availability of this training, the History Center can now provide it remotely as a webinar. Hochheiser is ready to schedule and give it to any group of IEEE members who would like to learn how to do oral history. Sessions typically last approximately 1.5 hours, including time for questions. Please contact him at **s.hochheiser@ieee.org** for details and scheduling. The slides from the webinar are also available separately to any member who would like to learn more about oral history.

Title Slide of the History Center Oral History Webinar.

SURF CITY

A selection of sites which IEEE History Center staff have come across in the course of their work, and which might be of interest to our readers:

Grace's Guide: British Industrial History: **http://www.gracesguide.co.uk/Main_Page** A remarkable resource of company histories and scanned images, documents, and magazines, including a substantial run of *The Engineer* and its indexes between 1856 and 1926.

IT History Society: **http://ithistory.org/museums/museums.php** A listing of nearly all information technology archives and museums (on-line and physical).

Beautiful Italian demonstrations of electrical technologies from the Fondazione Scienza e Tecnica **http://www.youtube.com/user/florencefst/videos?sort=dd&view=0&page=1**

Maritime Radio Historical Society: **http://www.radiomarine.org**

The papers of Kenneth Harper: **http://ccdl.libraries.claremont.edu/cdm/landingpage/collection/khp** Includes original correspondence, manuals, memoirs, and other documents related to the Civil Communications Section under General MacArthur's command in Tokyo after World War II. The papers tell the story of how Americans shared their industrial management know-how with the Japanese.
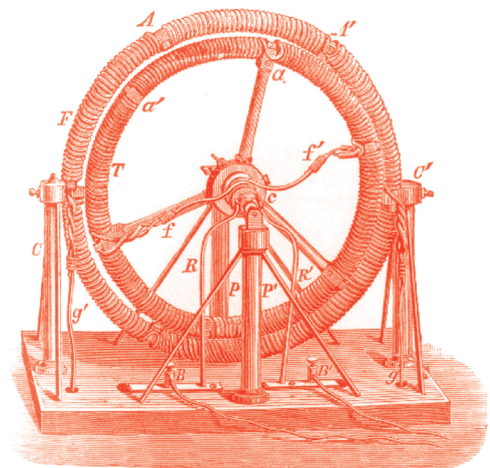
ETHERNET FORTIETH ANNIVERSARY

IEEE celebrates the fortieth anniversary of the invention of Ethernet—an invention which allows computers to communicate with each other and with their peripheral devices. Ethernet is what allows computers to do what they do. IEEE is celebrating the anniversary in various ways, and the History Center is participating. Staff has written an article about the invention of Ethernet, which will be appearing in the July issue of *The Institute*. The History Center's archives contain an oral history with Ethernet inventor Robert Metcalfe available on-line at **http://www.ieeeghn.org/wiki/index.php/Oral-History: Robert_Metcalfe**

To learn more about the fortieth anniversary of Ethernet celebrations, please visit **http://standards.ieee.org/events/ethernet** and for more information on the IEEE 802.3 Ethernet Working Group please visit **http://standards.ieee.org/develop/wg/WG802.3.html**

GRANTS AND FELLOWSHIPS

JACOB GABOURY IEEE LIFE MEMBERS FELLOW IN ELECTRICAL HISTORY

Jacob Gaboury is a doctoral candidate in the department of Media, Culture, and Communication at New York University. His dissertation project is titled *Image Objects: Computer Graphics at the University of Utah, 1965-1979*, and it investigates the early history of computer graphics and the role they play in the move toward new forms of simulation and object oriented design. With a focus on the pioneering research center at the University of Utah, the project seeks to uncover this largely neglected history and in doing so describe a fundamental transformation in the way we understand and interface with technical objects.

DONORS AND SUPPORTERS

PROFILE OF A HISTORY CENTER DONOR: ARTHUR CLAUS IEEE SENIOR MEMBER

"We are not far removed from the history of the creation of our profession"

A member of IEEE since 1990 with experience in the software, telecom and— for the past twenty years— semiconductor industries, Arthur Claus would be considered in mid-career. This is a time when many members might just begin to think about the history and heritage of their work. Arthur, however, has been donating to the IEEE Foundation's IEEE History Center Fund at the Bronze level for almost two decades.

He joined IEEE because it was the best organization he found for keeping up with his profession, particularly professional interests that were not directly job-related. However, he quickly realized that he was making technological history and that this history was fleeting. So Arthur decided to support the IEEE History Center, the best place for capturing the history of the profession while the original sources still exist. "I feel that we are not far removed from the history of the creation of our profession," says Arthur. "Each of us only has an understanding of a small area of the knowledge base that is IEEE, and without broad-based participation an accurate history cannot be maintained." Such participation is made possible by the central activities of the IEEE History Center, and Arthur is particularly interested in the oral history program, which preserves the memories of engineers for the historical record. Arthur added, "We have an opportunity to leave an accurate picture so that our descendants will not have to guess what happened during our time, in an area that will very likely have played a major role in shaping the world they live in."

IEEE HISTORY CENTER: PRESERVING OUR HISTORY WHILE ADVANCING THE PROFESSION

Advancing the prestige of the engineering and computing professions in the eyes of the public is of paramount importance to the IEEE History Center. To succeed at its quest, the Center depends upon the generosity of its many friends and donors.

The IEEE History Center delivers its resources to the fingertips of the public through the IEEE Global History Network (GHN), **www.ieeeghn.org**, an open access Wiki-based Web site. The GHN continues to grow in content and popularity, with the number of visits and visitors more than doubling, year after year.

The following programs are featured on the GHN:

Oral Histories record and share the memories of hundreds of professional icons.

More than sixty oral histories were added to the GHN in 2012, including fifty interviews of important female computer pioneers, making the Center the only repository for oral history interviews with both Timothy Berners-Lee and his mother!

IEEE Milestones in Electrical Engineering and Computing honor technological achievements worldwide.

First-Hand Histories empower technologists from around the world to share their personal stories of technological innovation.

IEEE Significant Technological Achievement Recognition Selections (STARS) Program: peer-reviewed articles on the history of major developments in electrical and computer science and technology.

Archives contain the historically valuable records of IEEE.

Education Portal enables high school social studies teachers to develop, post and download, and use history of technology curriculum in the classroom. Through your continued support, the History Center promulgates the education of technological history.

Please Donate and Support IEEE History
www.ieeefoundation.org

The IEEE History Center relies on donations from individuals and organizations to sustain and expand its programs and to deliver its resources to the public. The IEEE Foundation provides philanthropic services to IEEE and administers donations to the History Center.

Donor Recognition

Every donor who donates to one or more of the Center's funds administered by the IEEE Foundation makes an impact. The IEEE Foundation expresses it gratitude and appreciation by recognizing donors of US $100 and more in various categories among two donor recognition groups: The Advocates Association and The Leadership Association.

Contact **donate@ieee.org** *for more information. Donations within the United States are tax deductible. As a U.S. 501(c)(3) organization, the IEEE Foundation is eligible to receive tax-deductible contributions in the United States. For other countries, please check with your local tax advisor regarding tax deductibility of charitable contributions. The IEEE Foundation Employer Identification Number (EIN) is: 23-7310664. You may donate online* **ieee.org/donate**. *To learn more, visit* **http://www.ieeefoundation.org**.

IEEE Foundation grants are made possible by our donors who generously give to the grant making funds of the IEEE Foundation.

Two History related Grants Awarded in 2012 were:
The Sarnoff Study Center
and Satellites Transforming our Lives

OBITUARY

IN MEMORIAM TAKASHI SUGIYAMA, 1924 – 2013
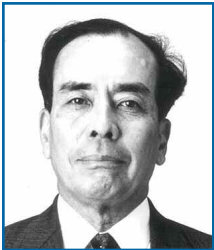
IEEE and the IEEE History Center have suffered a great loss with the death of IEEE Life Fellow Takashi Sugiyama. Dr. Sugiyama's contributions to technology, from his dissertation, "Pulse Width Modulation A/D Converter," to his contributions to the Japanese and global industrial economy as Vice President of Yokogawa Electric Company and then President of Yokogawa Medical Systems, are well documented (see his topic article and **oral history interview** on the IEEE Global History Network). He also served as a mentor for at least two generations of Japanese electrical engineers.

For many years, Dr. Sugiyama was a friend and advocate for IEEE's historical activities. If you look back at the honor role of donors in **the previous (March 2013) issue of this newsletter**, you find Takashi Sugiyama listed at the top in the "Preservationists Circle." This list honors and recognizes the people and organizations that made "significant contributions to the History Center at crucial stages in its founding and development."

While his inclusion on that list is because of his incredible financial generosity, even more incredible, was the time that Tak—as he was known to his IEEE second family—took to actively participate in IEEE's historical programs. Early on, he became active in the historical activities of the IEEE Tokyo

Section (later the Japan Council), and was a leading force behind the first IEEE Milestone in Electrical Engineering and Computing in Japan, **the 1924 Directive Short Wave Antenna,** dedicated in 1995. Today, thanks to pioneers like Takashi Sugiyama, there are now more than 130 dedicated IEEE Milestones worldwide, and the Japan Council remains one of the most active IEEE organizational units in proposing Milestones; seventeen of those Milestones are in Japan!

When the IEEE Foundation established the Trustees of the IEEE History Center to help raise funds for IEEE's historical activities, Tak was there with his time, hard work, and connections, as well as his personal generosity. When the Trustees were disbanded, Tak was named a Trustee Emeritus in recognition of his outstanding effort on our behalf. In 2010, the IEEE History Committee also recognized him for his lifetime of historical activity on behalf of IEEE.

Takashi Sugiyama will be missed by Japan, world engineering community, IEEE, and, especially, by the IEEE History Center.

To honor the to the memory Dr. Takashi Sugiyama , tribute gifts may be made to the IEEE History Center Fund of the IEEE Foundation at **www.ieee.org/donate**. If you have questions or need assistance making the gift, please call +1 732 562 5550 or email **donate@ieee.org**.

HOCHFELDER, DAVID
The Telegraph in America 1832-1920, 2012
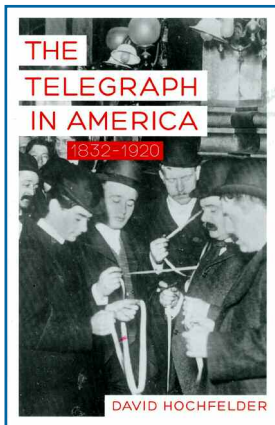
In the beginning there was the electric telegraph. The telegraph was the original electrical technology, and thus can be considered the root from which all of the myriad fields of IEEE's interests sprang. Thomas Edison, as is well known, began his career in telegraphy. Until recently, while there have been many books on particular aspects of the history of the telegraph, there had been no broad treatments of the role of the telegraph in American life. Now in just a few years, there have been two—Richard John's *Network Nation* (**reviewed in Newsletter #86, July 2011**) and this new book by former (1998-2001) IEEE History Center Post-Doctoral Fellow David Hochfelder. Hochfelder establishes that that the telegraph was a truly revolutionary technology in two ways, both in technological practice and perhaps even more importantly in the way that people communicated and obtained information, and thus in the expectations that they had about the availability of information. The telegraph forever liberated communications from transportation.

Hofchfelder begins with a short discussion of the early history of the telegraph in the U.S. from Samuel F. B. Morse's invention and first experimental line in 1844 to the rapid development of a national network into the 1850s. This network primarily served two clienteles, businessmen (particularly speculators), and the press. Then, through a series of four chapters that are simultaneously thematic and chronological, he examines the role of the telegraph in American life during the technology's heyday, roughly from 1860-1920, from the emergence of a national privately-owned telegraph network to the eclipse of the telegraph by the telephone. He follows these chapters with one on the long decline of the telegraph through the remainder of the twentieth century, and a short conclusion.

In the first of these chapters, on the role of the telegraph in the Civil War, Hochfelder demonstrates the important and transformative role the telegraph played in the Northern triumph. Through extensive use of the telegraph network, both strategically and tactically, the civilian leadership in Washington was able to supervise the generals in the field, while providing coordination and leadership. And the field leaders were able to better coordinate with one another, and seek supplies and reinforcements. For the first time, news reports from the fighting reached the public quickly, as newspapers widely reported telegraphed dispatches. And because the United States Military Telegraph was basically a civilian operation, run by officials of the private telegraph companies commissioned for this purpose, this more closely knit the six major regional telegraph companies together, a major factor in their all consolidating into the Western Union Telegraph company in 1866. Western Union would remain the dominant telegraph company, with never less than an 80% market share, for the rest of the technology's life.

In the next chapter, on the failure of the Postal Telegraph movement, Hochfelder covers the periodic attempts to have Congress establish a government-operated telegraph system, either by nationalizing Western Union and its smaller competitors or by setting up a competing system. The proponents had two main overlapping objectives—first, a concern over monopoly control over the flow of political and financial news, and second, a belief that the telegraph should be a popular communication medium like the post office, rather than an expensive, exclusive service used only by a few classes of businesses, and the press. Their efforts ebbed and flowed with the state of Western Union's monopoly, and failed, in part because the telegraph's customers were satisfied with the status quo, which favored speed and reliability over price.

In his chapter on the telegraph, written language, and journalism, Hochfelder notes that the telegraph was the first new technology to interact with language since the printing press. But then he concludes that the effect of the telegraph on the evolution of language in the United States is complex and for the most part indirect, since for the most part people read newspapers, whose editors largely used telegraph dispatches as raw material to be rewritten and incorporated into stories. Thus the terse language and codes used in telegrams, where users were charged by the word, did not affect people's usage. Hochfelder also shows how quick dissemination of the news by telegraph led to a new pattern of news consumption, with a news cycle expectation of frequent updates, and a public sense of vicarious participation in distant events.

This is followed by a chapter on the role of the telegraph in the rise of financial capitalism. The telegraph, in its specialized iteration as a stock ticker, rendered financial information publicly and widely available, at least to those who could subscribe or have access to a ticker. In doing so it transformed stock exchanges from markets in tangible items to markets in information, and to increased—though still limited—public participation and investment in capitalistic enterprises through a network of stock brokers. It led, interestingly, to a second type of business, commonly known as "bucket shops" which further democratized participation by allowing larger groups of people to speculate on the movement of the prices of stocks. The differences were several: bucket shops dealt in far smaller units of stock, were open to everyone, and, crucially, were simply betting parlors—no actual stocks were bought and sold. It took decades, and both a Supreme Court decision in 1905 confirming that stock quotations were property of the stock exchanges, and a 1909 Act of Congress outlawing bucket shops in the District of Columbia to lead to the demise of bucket shops. A legal distinction between speculating in stocks and gambling, previously contested, had been established.

In his last full chapter, Hochfelder carries his story past the 1920 date in his title to modern times, thus telling the story of the entire lifecycle of this one central technology. He traces the long decline of the telegraph in relation to the telephone. The decline began before the telephone was well-established, with the well-known 1879 agreement between Western Union and the young Bell Telephone Company (AT&T's predecessor), where Western Union agreed to leave the telephone business in return for a royalty on every telephone until 1894, and Bell's agreement to stay out of the message telegraph business. Hochfelder brings new insight to this agreement, and how it was put into practice, thus refining our understanding of the beginning of the long relationship between the two companies. He analyzes the short period 1909-1914 when AT&T gained operational control of Western Union, and the long, slow, decline of Western Union afterwards, a decline characterized by its relationships with both AT&T and the federal regulators, and Western Union's ultimately unsuccessful efforts to expand beyond the declining telegraph business to a broader business in electrical communications. Western Union transmitted its last telegram in 2006. Finally, in a short conclusion, Hochfelder sums up his work, characterizing the history of the telegraph as a combination of possibilities and limitations inherent in the technology, and a narrow vision of the telegraph's social role and utility. Ultimately, the telegraph was less a communications medium than a medium for the distribution of information.

SCHMITT, LAURA,
The Bright Stuff: The LED and Nick Holonyak's Fantastic Trail of Innovation, University of Illinois Micro and Nanotechnology Laboratory, 2012
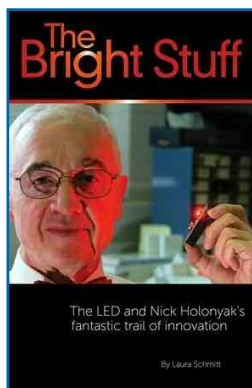
One can now buy a 9.5-watt, dimmable, LED light "bulb" providing the equivalent light of a 60-watt bulb for $12-13. This is not far from the industry prediction of the end of incandescent lighting when the price of LED lights for the home drops below $10 each. By 2020 LEDs could account for 90 percent of electric lighting, leading the author of this slim volume to observe that children "born today may never even know what a filament-based light bulb is." *The Bright Stuff* explains the role of Nick Holonyak in making this prospect, and all its environmental benefits, possible.

Schmitt relates the development of LEDs through the evolution of Holonyak's career, working backwards and forwards in time, starting with his commercial red LED, GaAsP laser, and proof of the efficacy of direct bandgap semiconductors for General Electric in the early 1960s. There he succeeded because of his experience working with III-V materials in tunnel diodes and in spite of corporate discouragement. We read of the multiple successes of his lab group at Illinois, from the first quantum-well laser in 1976 to the first transistor laser in 2004. We go back to his training under Nobel laureate John Bardeen at Illinois and forward to the influence of Holonyak's techniques and students throughout the commercial LED industry. Through it all, references to Holonyak's upbringing as the son of a southern Illinois miner help explain his approach to problems and processes, but they do not necessarily explain why Holonyak has the "right stuff."

To give life to the story of technological development and institutional promotion, Schmitt draws liberally on interviews and oral histories. Many of the latter were conducted by History Center staff and are available on the Global History Network (**http://ieeeghn.org/wiki/index.php/Special:OralHistories**)

Available only in an e-book Kindle edition via Amazon.com, *The Bright Stuff* was written by the former director of communications for Illinois's Electrical & Computer Engineering Department. Schmitt notes that she writes "for today's high school and college students. . . . I wanted to not only inform them of what's coming, but celebrate the people who made it all happen." (p. 2) Clear writing, primary sources, pertinent and colorful images, and a well-rounded story of the people involved in advancing LED technology make this a fine book for young and old alike.

Available from: **www.amazon.com/The-Bright-Stuff-Innovation1-ebook/dp/tech-data/B009K51USW?SubscriptionId= AKIAJ5VYSCUYLBSJFD5A&tag=httpwwwscribd-20&linkCode=xm2&camp=2025&creative=386001&creative ASIN=B009K51USW**, $9.99, kindle, 978-0-615-61800-9, 96 pp.

BELL LABS MEMOIRS: VOICES OF INNOVATION
published by the IEEE History Center

The innovative spirit and creative energy of Bell Labs during the directorship of William Baker are described in this new book by twelve people who worked there. The first-hand accounts are by: John Pierce, father of communications satellites; Manfred Schroeder, speech encoding; Walter Brown, developer of silicon semiconductors; Carol Maclennan, computers and the Ulysses spacecraft; Alan Chynoweth, materials research, David Dorsi, expert glassblower; Edward Zajac, submarine cables and economics research; Edwin Chandross, optical memories and organic materials (inventor of the now ubiquitous light stick); Italo Quinto, chauffer to William Baker; Mohan Sondhi, inventor of the adaptive echo canceller; William Keefauver, Bell Labs' general patent attorney; and lastly, William Baker himself. Through their eyes and words, the culture of Bell Labs comes to life.

The research done at Bell Labs led to many devices and techniques that helped build our present world. Acoustic cameras, adaptive predictive coding, block diagram compilers, cryptography, diamond crystal research, digital communication, echo research, inverse filtering, light-emitting diodes (LEDs), magnetic bubble memories, microwaves, organic field effect transistors, pulse code modulation, synthetic speech, transistors, traveling-wave tubes, and vocoders are among the topics recalled by the contributors to this book.

Available from Amazon.com in hard copy, and also on Kindle at: **http://www.amazon.com/Bell-Labs-Memoirs-Innovation-Geselowitz/dp/1463677979/ref=sr_1_1?s=books&ie=UTF8&qid=1320151019&sr=1-1**

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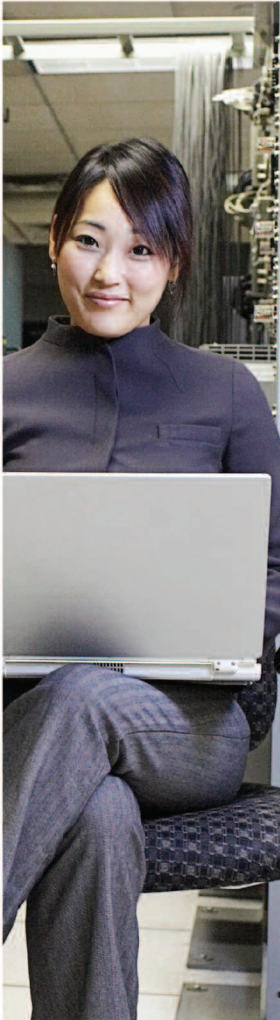
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