

# IEEE History Center

ISSUE 93, November 2013

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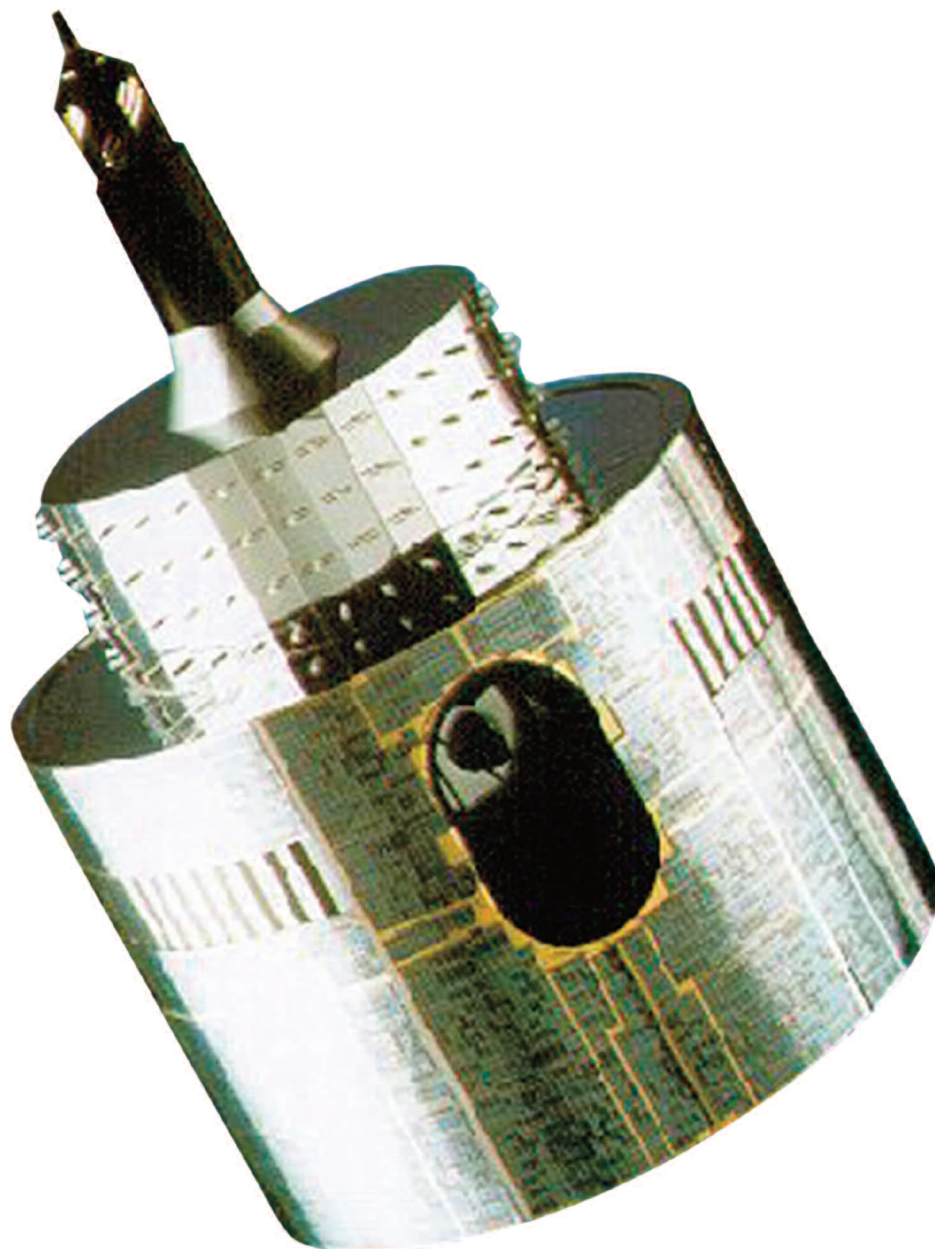
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The newsletter reports on the activities of the IEEE History Center and on new resources and projects in electrical and computer history. It is published three times each year—once in hard copy (March) and twice electronically (July and November) by the IEEE History Center.

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By Michael Geselowitz, Ph.D.

As I write this column, we are approaching the first anniversary of “Superstorm Sandy,” which devastated the New York metropolitan area where IEEE corporate headquarters, the IEEE Operations Center, and the IEEE History Center are located. It is still too recent—and there is still too much recovery work to be done—to analyze the event historically. Yet the storm—which certainly one day will be in the history books—has already once again taught us the lesson that 21st century society relies on power infrastructure to function. It reminded us of another reality as well—that large, complex technological systems in the

modern era cut across disciplines. This fact was made clear no more strongly than in the transportation systems in and around New York and New Jersey and their failure to operate during and for long periods after the storm. These systems rely on civil, mechanical, and electrical (and, in case of the diesel portions of the largely electrical system, chemical and petroleum) engineers to be developed, designed, built, operated, and maintained.

It is therefore appropriate that immediately in the wake of the storm, our initiative to bring the historical content maintained by the other Founder engineering societies onto the IEEE Global History Network has so rapidly

### 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](mailto:ieee-history@ieee.org)

Current and past issues of the newsletter can be accessed at: [www.ieee.org/about/history\\_center/newsletters.html](http://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](http://www.ieee.org/donate) or [www.ieeefoundation.org/](http://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](mailto: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](mailto: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](mailto:r.colburn@ieee.org).

picked up steam (apologies to our mechanical engineering colleagues for stealing their metaphor). The project, has the potential to create a single source where the public can go to learn about and appreciate the role of engineers and engineering in building the modern world, including the vast transportation systems that bind it together.

I hope you will continue to follow this exciting development and all of our other activities through the newsletter, our website, and other communications that we may send our from time to time. Although we have a grant from the United Engi-

neering Foundation for this particular project, this November newsletter column is my annual opportunity (given the cycle of philanthropic giving, especially in the United States) to remind you that most of those other activities are supported by philanthropic giving from you, our loyal supporters. I hope, as the end of the year approaches, you will consider an additional gift to us, perhaps when you renew your IEEE membership or complete your IEEE Life Member profile.

Finally, let me take this opportunity to wish you and yours a pleasant holiday season and a healthy and happy new year.

## CENTER ACTIVITIES

### INFLUENCE AND IMPACT: HISTORY CENTER ARTICLES DRAWING A WIDE READERSHIP

The IEEE History Center has been collaborating with other IEEE publications to expose more people to technological history. Working with *The Institute*, History Center staff have pioneered a series of articles called "Do You Know?" in which little-known events in technological history are brought before a wider audience. The concept has been widely successful; and audiences are responding. History articles are avidly read, and account for eighteen percent of the total views for *The Institute*. Senior Director Dr. Michael Geselowitz's article on Heaviside and Maxwell, "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> garnered the highest views ever for an article in *The Institute*. More than 33,000 people have viewed it, and this represents six percent of *The Institute's* total page views. Outreach Historian Dr. Alex Magoun soon followed up that grand-slam home run with "Did You Know? Edison Coined the Term 'Bug,'" <http://theinstitute.ieee.org/technology-focus/technology-history/did-you-know-edison-coined-the-term-bug> which has garnered almost 23,000 views, the second-highest number of views for *The Institute*. The number three spot is also occupied by a history article: "Did You Know? Historical Facts Which Are Not True"

<http://theinstitute.ieee.org/technology-focus/technology-history/did-you-know-historical-facts-that-are-not-true>

Institutional Historian Dr. Sheldon Hochheiser's article "The History of the Hearing Aid" was the most viewed article in the issue of *The Institute* in which it appeared, claiming the seventh spot overall: <http://blogs.missouristate.edu/ats/2013/08/02/the-history-of-hearing-aids/>. Number eight was also from the History Center, "The Ethernet Turns 40." Those five articles account for nearly 100,000 views.

IEEE's *Today's Engineer* <http://www.todaysengineer.org/archive/default.asp> has also found that history articles appeal to readers. The past illuminates the present. IEEE History Center staff contribute monthly articles to *Today's Engineer* on a variety of topics in the field of technological history, and five of those articles made *Today's Engineer's* top hundred most-viewed for 2013. Web Content Manager Nathan Brewer's history of bulletin board systems tops the list of History Center contributions <http://www.todaysengineer.org/2013/Mar/history.asp>.

The IEEE History Center page is the 5th most heavily-trafficked page of the IEEE's web site.

All of this confirms that the historical activities of IEEE are a vital contribution to the profession.

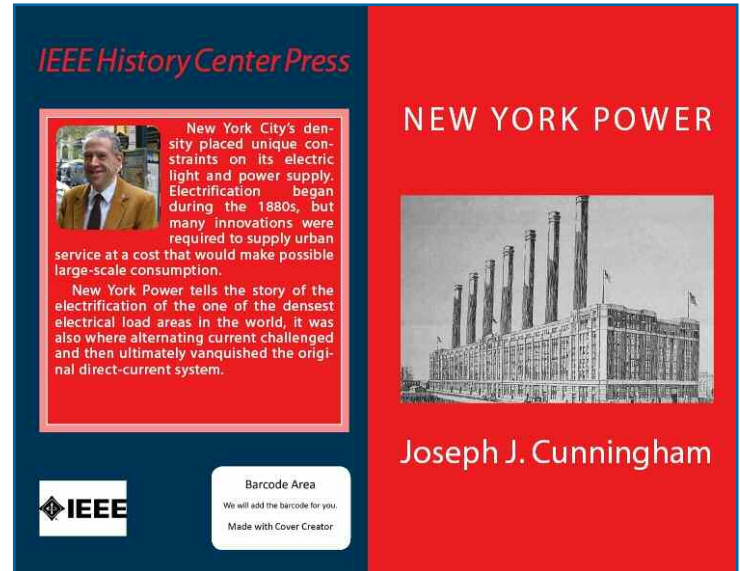
### THE IEEE HISTORY CENTER IS LOOKING FOR BOOK AUTHORS

The IEEE History Center Press is interested in working with authors to publish books on the history of electrical and computing-related technologies. [http://www.ieeeahn.org/wiki/index.php/Archives:IEEE\\_History\\_Center\\_Book\\_Publishing](http://www.ieeeahn.org/wiki/index.php/Archives:IEEE_History_Center_Book_Publishing) The IHC Press works with Amazon.com to publish handsome print-on-demand trade paperback and Kindle® versions. The IHC Press works with a professional indexer with experience in indexing scientific and technological books to prepare an index for your work. (Please note that the IEEE History Press does **not** publish books on current topics in Electrical Engineering). If you

would like your work to be considered for publication by the IEEE History Center, please send the complete manuscript as a Word file to [ieee-history@ieee.org](mailto:ieee-history@ieee.org) for consideration. The History Center Press suggests following the *Chicago Manual of Style*; however, it is not firmly committed to a particular style. Clarity is the objective. There are a few stylistic preferences: Dates in international format (e.g. 22 July 2013); spell out numbers less than 1000. Use SI units, or English units accompanied by their SI equivalents.

**FORMATTING INSTRUCTIONS AND CHECKLIST:**

- 1) Book manuscript (as a single Word file)  
Format: Times Roman, 12-pt, left-justified, no spacing. Five-space indents. Page breaks between chapters, Chapter headings in Times Roman 22-pt bold.  
Format for indicating images: <insert image FOTO1.JPG>  
*Caption in Italics underneath*
- 2) Introduction and/or Forward
- 3) Acknowledgements
- 4) Appendices
- 5) Image files: jpg or tiff, resolution 300 dpi or higher
- 6) Copies of Reuse Permissions from the copyright owners of any material you are reusing (such as images, quotations from other publications, etc.)
- 7) Photo credit page
- 8) Author photograph for back cover: 1.5 inches by 1.5 jpg or tiff, resolution 300 dpi or greater
- 9) Front Cover image: jpg or tiff, resolution 300 dpi or greater



## 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 maintains 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 74,000 followers as of September, 2013 and more than 17,000 social interactions. Three of the posted images were featured on Tumblr's Radar, a feature that allows the Tumblr staff to broadcast images they feel are interesting to all logged-in Tumblr users. To follow the blog or view the images, go to <http://engineeringhistory.tumblr.com/>.

## ARCHIVES UPDATE: HISTORICAL ETA KAPPA NU FILMS

Eta Kappa Nu (or HKN), the electrical engineering honor society, was founded at the University of Illinois in 1904, and over the years established branches at many American universities with electrical engineering Programs. HKN has long had a close relationship with IEEE, culminating in 2010 when HKN merged into IEEE, and became IEEE-HKN, the student honor society of IEEE. As a result of this merger IEEE Archives accessioned several cartons of HKN historical archival material. Notable among the material were two copies each of two old 16mm films, respectively titled "Engineering: A Career for Tomorrow" and "Engineering: The Challenge of the Future." Unfortunately, there was no 16 mm projector available at IEEE with which to screen the films. There were however, booklets describing the films among the materials. The films, dating from 1954 and 1968, were both productions designed to encourage high school students to consider enrolling in college engineering programs and

train for careers in engineering. The brochures offered to loan copies of the films to schools and other use groups. 16mm films may be an obsolete medium but encouraging young people to enter engineering continues to be an IEEE interest.

When History Center Archivist and Institutional Historian Sheldon Hochheiser met with Nancy Ostin, the newly appointed Executive Director of IEEE-HKN, among the archival material he showed her were the two films. Nancy found these films quite intriguing and agreed that we should send the films out to be digitized so that they could be seen and used by IEEE-HKN and IEEE at large.

The films proved to be quite interesting, both in their approach and how they characterized engineering education and the engineering profession in the years in which they were made.

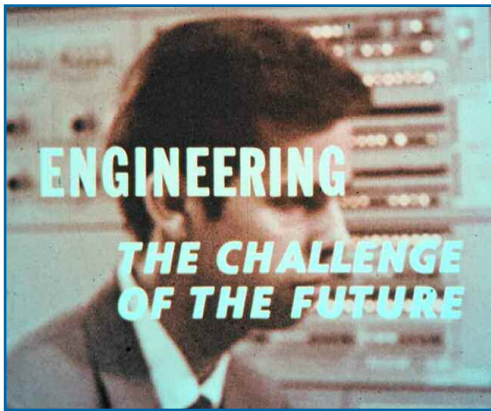
"Engineering: A Career for Tomorrow" was largely filmed at the University of Illinois, Urbana-Champaign with assistance



(and film clips) from several Illinois companies. It takes place at a high-school career day, where Joe Williams, a high school student, meets with Mr. Paul Kelly, an engineer who explains the requirements to be an engineer,

what the engineering college curriculum is like, and what he and other engineers do in their careers in industry.

“Engineering: The Challenge of the Future” is a more sophisticated production, no doubt because of a larger budget that allowed the use of a professional production company



and the participation of industries throughout the US. It was again filmed in part at the University of Illinois. It features many engineering students, engineering professors, and working engineers talking about their training and

work. It emphasizes how engineers work to solve society’s problems, thereby going beyond solving industrial problems for their employers.

One thing striking about watching the two films together is the way the engineering profession had changed in the intervening years. In the earlier film, calculations are done manually, and the areas of engineering most emphasized are power and communications. In the latter, engineers work at computer terminals, and much time is devoted to newer areas including space exploration, electronics, and environmental engineering.

HKN Executive director Ostin was so pleased with the films that she arranged to have DVDs made and sent to every one of the more than two hundred IEEE-HKN Chapters. For its part, the IEEE History Center has posted both films on the IEEE Global History Network. You can find them on-line at [http://www.ieeehkn.org/wiki/index.php/Archives:Engineering\\_-\\_A\\_Career\\_for\\_Tomorrow#Abstract](http://www.ieeehkn.org/wiki/index.php/Archives:Engineering_-_A_Career_for_Tomorrow#Abstract) and [http://www.ieeehkn.org/wiki/index.php/Archives:Engineering\\_-\\_The\\_Challenge\\_of\\_the\\_Future](http://www.ieeehkn.org/wiki/index.php/Archives:Engineering_-_The_Challenge_of_the_Future)

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

**IEEE Global History Network**  
[www.ieeehkn.org](http://www.ieeehkn.org)

## 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:

British Telecom Archive: <http://www.btplc.com/Thegroup/BTshistory/BTgrouparchives/> BT Archives preserves the historical information of British Telecommunications plc and its

predecessors from the early part of the nineteenth century up to the present day; effectively the history of telecommunications services in the United Kingdom and from the UK to overseas.

Intel Company History, newspaper and magazine clippings: <http://www.intel.com/Assets/PDF/General/15yrs.pdf>

## AWA MUSEUM OPENS AND NEW WEBSITE LAUNCHED

By David and Julia Bart

The Antique Wireless Association held its 52nd Annual Convention on August 20-24. The featured program topics included Heathkit, Lee deForest, WWII television, Enigma code machines, WWII military radio, and overviews of Australian and Swedish radio museums. The contest room featured a record-breaking 84 displays; and the international dinner, the flea market, book fair, and large auction were all well attended.

A highlight of the conference was the grand re-opening of the Antique Wireless Museum at its new location in Bloomfield, New York. The AWA formally dedicated the Thomas Peterson, Jr. Antique Wireless Museum and Research Campus on 20 August with about 150 visitors on the first day. Development of the full complex is showing tremendous progress, and the first phase of the main museum is now open. When fully developed, the 10,000 square foot museum will feature a 60-seat auditorium, live operating radio stations, 14 permanent and 26 rotating exhibits, full handicapped access, professional conservation climate controls and fire-flood safety measures along with ample parking for cars and tour buses. The open portion

of the new museum fills approximately 1/3 of the main building. The remaining 2/3 is scheduled for the additional phases of the build-out over the next several years. The Dr. Max Bodmer Media Center (holding the Bruce Kelley Library and the Radio Club of America Archives) has been open since 2009, and the Gauss Road workshop is in heavy use.

The AWA also launched its new website in conjunction with the conference. The website "A New Beginning..." is significantly redesigned and updated to include current information, resources, the bookstore, links to other organizations, photos of recent events and membership information. A particular highlight is the new interactive map of the museum which has photos of the exhibit installations. The AWA plans to continue developing and expanding the content of the website, so comments and return visits are encouraged.

The enthusiasm level was extremely high and AWA attracted a range of people from across the world to its Convention. Look for significantly more information about AWA and news about next year's 2014 Convention on its website at <http://www.antiquewireless.org/>.



*An authentic replica of the Titanic Marconi Room at the new AWA Museum in East Bloomfield, New York.*



*An authentic replica of a 1925 radio store at the new AWA Museum.*



*The first RCA portable television camera at the new AWA Museum.*



*Pioneers of Wireless exhibit at the new AWA Museum.*

## SARNOFF COLLECTION EXHIBIT AND LEARNING CENTER OPEN

As George Brown recalled David Sarnoff saying, "It took a little longer than I wanted, but it's exactly what I had in mind." On 3 October, four days after the anniversary of the beginning of Sarnoff's career in wireless communications, and four years after The College of New Jersey in Ewing, New Jersey, acquired the David Sarnoff Library's collection, "Innovations that Changed the World" went on display. More than 100 TCNJ students attended the event, which also attracted dozens of former RCA staff and members of the Sarnoff family. The exhibit displays some of the 6,000 items TCNJ received from Sarnoff's library at RCA's Princeton laboratories (the site of three IEEE Milestones). It highlights nine technologies, using eighty selected artifacts and numerous photos and marketing materials to explain how Sarnoff, RCA, and its research and manufacturing staffs brought radio, television, electron microscopy, solid-state electronics, computers, and other technologies to market.

In consultation with Croll and a committee of faculty from across the arts and sciences, curating historian Benjamin Gross selected, arranged, and described the objects, all within a well-lit room colored a warm autumnal orange. In brief, thoughtful introductions and captions, he fuses the story of Sarnoff's life and career with the developments at RCA's laboratories and factories during the most American of centuries. Included among the displays, some behind Plexiglass and some secured and exposed, are Sarnoff's telegraph key, the first full-color TV tube,

the first thin-film transistor, one of RCA's first electron microscopes, RCA's first magnetic computer memory and home computer, and one of its first liquid crystal displays. The exhibit highlights not only the creative spirit and dedication that goes into the best engineering, but also offers glimpses of engineering's effect on popular culture, from the advertising that sold new technologies to consumers to a working 1938 console radio and a 1948 television.

Literally around a corner from the exhibits is a 100 square-meter study center, funded by a generous grant from the IEEE Foundation. Here students from across the college's departments in engineering, science, business, communications, history, education, and public policy can meet to engage with all facets of the process of innovation. They will be able to work directly with artifacts on display or stored and cataloged on nearby shelves; digitized imagery, technical reports, and RCA publications; and, of course other resources online or from the college's nearby library. The college's Center for Excellence in STEM Education looks forward to hosting programs as for high school students as well, while another on-campus center expects to host field trips for elementary and secondary school classes.

The museum is open to the public on Wednesday afternoons from 1 to 5 p.m. and on Sunday afternoons from 1 to 3 p.m. For more information, visit The College of New Jersey's webpage at <https://davidsarnoff.pages.tcnj.edu/>.

## GRANTS AND FELLOWSHIPS

### PROGRAMS OF SUPPORT FOR SCHOLARS 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 thesis (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 hemi-

sphere 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](http://www.ieee.org/web/aboutus/history_center/about/fellowship.html). The deadline for completed applications is 1 February. Applicants will be notified of the results by 1 June.

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 schol-

ars 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 near 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.

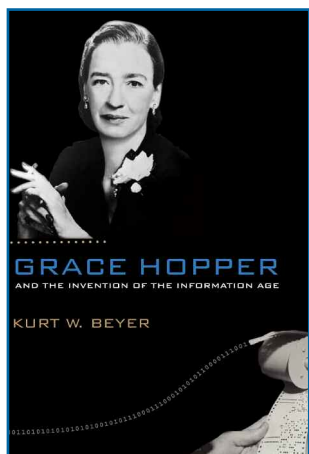
The stipend paid to the intern is US\$3,500, but additional funds may be available to defray travel costs, depending on the intern's circumstances. This internship is supported by the IEEE Life Members Committee.

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.

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](mailto:ieee-history@ieee.org), [http://www.ieee.org/web/aboutus/history\\_center/index.html](http://www.ieee.org/web/aboutus/history_center/index.html)

## BIBLIOGRAPHY

BEYER, KURT W.,  
*Grace Hopper and the Invention of the Information Age*, MIT Press, 2009



Whether or not you are one of those who recognize Grace Hopper as the inventor of programming or more specifically Cobol, Kurt Beyer has done you, Hopper, and the histories of early computing and software a great service. This "distributed biography" draws on years of research in the archival papers of Hopper and her colleagues, the secondary literature, and voluminous oral histories of computer pioneers. Beyer uses these sources to demythologize his subject by examining what precisely she and her many colleagues accomplished in the first generation of modern computing.

The story begins with Hopper's decision to join the U.S. Navy after the Japanese attack on Pearl Harbor. She left her husband as well as her faculty position in mathematics at Vassar College to immerse herself in the challenges of working for Howard Aiken on his electromechanical computer, the Mark I, also known as the Automatic Sequence Controlled Calculator. Hopper succeeded by mastering the Mark I's design and operation and absorbing as much information as she could from co-workers on the processes of coding the instructions. Beyer gives these people their due in the course of relating the invention of programming, including sub-routines, and debugging hardware and software in 1944-45. He also covers the prickly nature and shortcomings of Commander Aiken, who brokered the agreement between Harvard and the Navy on the operation of the Mark I within the Computation Laboratory; the issue of simultaneous invention embodied in the sub-routine technique developed at Harvard and Cambridge University; the role of the Mark I's operation on John von Neumann's seminal writings on the concept of a stored-program electronic computer; and the differences between the Aiken/Hopper and IBM versions of computing history, embodied in their respective publications for the enormous machine that IBM had constructed.



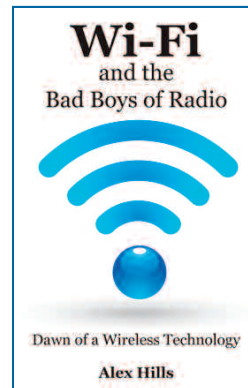
Beyer also examines the background behind the 1947 Harvard symposium and the formation of the Association of Computing Machinery (ACM) before delving into Hopper's personal struggles with alcohol in the post-war and post-Harvard environment. In 1949 she joined Presper Eckert and John Mauchly in their new company to commercialize the electronic computer they had built at the University of Pennsylvania. There Hopper worked with Betty Snyder to create a programming group and encouraged the latter's innovations, including a sort-merge generator. The excitement of a start-up is complemented by the tension, however, and with the unexpected death of its chairman, the company pioneering the UNIVAC was sold to Remington Rand. Hopper was jailed that November for being drunk and disorderly, provoking a friend's intervention to convince her to stop drinking. From this nadir Beyer pursues Hopper's greatest contributions in detail, the first of which is "automatic programming" using a compiler and a library of sub-routines. To promote the concept to her resistant corporation and the computing community, Hopper recruited volunteers for what Beyer calls "distributed invention." (p. 255) They ran a series of studies and comparisons on the efficiency of compiling versus conventional programming, and Hopper shared the design of the A-2 compiler with multiple organizations in an early version of open-source collaboration.

The success of Hopper's initiative and Remington Rand's control of the only commercial electronic computer suggest that it should have become the new industry's leader. Instead, IBM triumphed. Beyer argues that it was more the advantage IBM gained from the government's subsidy of research and development for the Whirlwind and SAGE projects than any inherent IBM strength or Rand inability to capitalize on its advantages. Throughout this period Hopper pursued the extension of automated programming through her collaborative approach. She aspired to writing programs in plain English for the solution of business problems and decisions, arguing to her management and to the programming community at large on the virtues of the B-0 business language, which Rand renamed FLOW-MATIC in 1958. The increasing sophistication and diversity of programming languages led to a government-industry effort to standardize on one alone. The result, in which Hopper played a major role, was COBOL, and Beyer explains how COBOL not only survived widespread criticism but became the world's dominant computer language.

Beyer essentially ends his story there, leaving the reader to admire Hopper's visionary approach not only to the uses of computers but the methods by which to improve them. His highlighting of Hopper's work in the corporate and professional worlds of computing complements Kathleen Broome Williams's *Grace Hopper: Admiral of the Cyber Sea* (2004), which largely focuses on Hopper's naval career. The result is a searching and invaluable portrait of a remarkable woman accomplishing a great deal within the contexts of the many people and organizations that laid the foundations of the American computer industry and the "Information Age."

Available from: MIT Press, Cambridge, MA, 800-405-1619, 617-258-6779, <http://mitpress.mit.edu/books/grace-hopper-and-invention-information-age>, \$24.95, softback, 9-780262-5-17263, 389 pp.

HILLS, ALEX,  
*Wi-Fi and the Bad Boys of Radio*, Dog Ear Publishing, 2011



The author, an IEEE Fellow sometimes credited as the "father of Wi-Fi," denies that honor but gives us a brief and warm memoir of his career in wireless communications. Like many of his generation of EEs, Hills began by earning his amateur radio operator's license and building a transmitter, wherein he contrasts the erratic behavior of electromagnetic radiation in northern New Jersey in 1952 with the problems people encounter today when using wireless networks. "Bad boys" is an awkward collective title for those natural obstacles to clear signal transmission and reception, bringing to mind the song by Inner Circle used for the reality television program *COPS*. Still, it's a useful device for explaining to a lay audience those five obstacles, from diffraction to shadowing, that have kept Hills and generations of engineers since Marconi busy devising ways to overcome them.

Not an autobiography, the book jumps from an undated review of radio and education at Rensselaer Polytechnic Institute in the early 1960s to Kotzebue, Alaska, ten years later. There, Hills gives readers an excellent feeling for life as a radio engineer in sub-Arctic conditions. We don't learn why he went, but the state depended on wireless communications to connect and unite its far-flung and isolated villages. Hills fills in descriptions of the daily routine with details of the clothing he wore and the care and feeding of the teletype machine that connected KOTZ to the Associated Press news service. Hills describes his co-workers and the programming as well as the special conditions (Aurora Borealis) and the bad boys of radio that made Alaska a useful training ground for an unanticipated future.

Twenty years later Hills locates us at Carnegie-Mellon University in the mid-1990s. This takes up the bulk of the book. Here again the author immerses us in the environment—the sounds, sights, and textures of the campus as it was. Some of the descriptions may seem all too familiar—conference room décor, sounds in the cafeteria—but for readers in another generation or two they may well not be. Most fascinating is the way in these impromptu or formal meetings with colleagues, university staff, graduate students, and representatives of AT&T and Lucent led to Wireless Andrew in "late 1995" (p. 95), arguably the world's first multi-building wireless local area network (LAN). While his dating can be vague, Hills provides references to both the history and technology of wireless LANs and Wi-Fi, which Hills's group adopted after the IEEE approved Standard 802.11 in 1997. He also describes his co-workers and partners, the processes of determining parameters and equipment for the project, and of course the bad boys that made effective coverage so difficult.

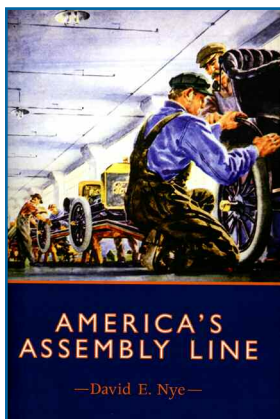
Hills concludes with his participation in a Silicon Valley wireless startup that helped pioneer practical, dynamic, secure networks in the early 2000s, and finally the state of Wi-Fi in the Alaskan town where he has retired. The author writes briskly and informatively in this self-published work, and we await a follow-up on his activities in-between his work on the bad boys.

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Available from: Dog Ear Publishing, Indianapolis, IN, [www.dralexhills.com/](http://www.dralexhills.com/), \$16.95, paperback, 978-145750-560-7, 144 pp.

NYE, DAVID E.,

*America's Assembly Line*, MIT Press, 2013



David Nye is likely the most influential and prolific historian on electrification and its implications in the United States. After a series of books in this area, Nye has now turned his attention to another famous product of industrializing America—the assembly line. After a short introductory chapter, Nye turns to the development of the modern system of mass production, commonly but later known as the assembly line, at the Ford Motor Company between 1908 and 1913. He notes that the development was not the result of a plan, but rather

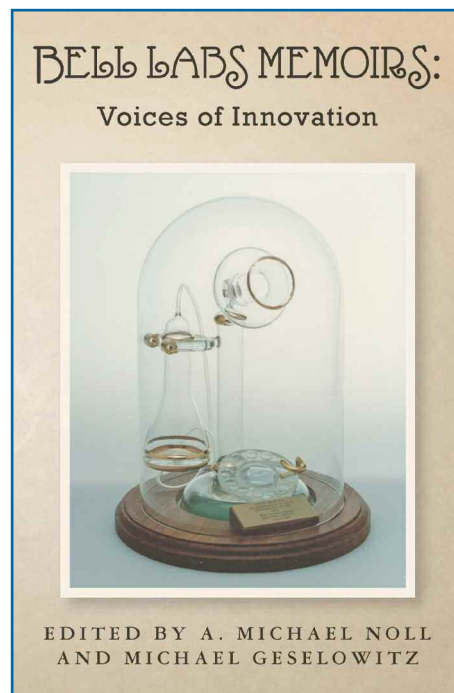
the work of a group of talented men, brought together by Henry Ford who sought ways to meet the ever-increasing demand for the Model T Ford. Over this period they incorporated what became the five defining characteristics of the assembly line, each adapted at least in part from practices in other industries. These were 1) subdivision of labor 2) interchangeable parts 3) single function machines 4) sequential ordering of machines and 5) the movement of work to the workers rather than the workers to the work. And underlying all of these was electrification—electric power and motors made it possible to lay out a factory according to the logic of the work, rather than the requirements of central steam power plants driving belts and pulleys. Number 5 was the last introduced. To much of the outside world it was the assembly line, but according to Nye it was not even the most important element.

The remaining eight chapters are devoted to taking the story from Detroit to the world, and from 1913 to the twenty-first century. Here Nye moves among three interlocking themes: 1) The history of the assembly line itself, and the ways it has evolved and been adapted in many places over many years; 2) A global history of Ford manufacturing with the assembly line; and 3) The changing cultural reactions to the assembly line in various time periods and places. In these chapters, Nye charts widespread American attitudes towards the assembly line evolve from celebration in the teens and twenties to a critical eye during the depression of the 1930s to acclaim as a key to American success during World War II and the Cold War to a new era of discontent in the 1960s and 1970s. Similarly, Nye follows the spread of the assembly line to partial adoption in Europe before 1940, as attempted adoption met with cultural differences, smaller markets, and less affluent societies; its transformation in the post-war Japanese auto industry into a form that became known as “lean production,” which had higher productivity and quality than the more traditional line; and finally the application of computers and robots, which further increased productivity while simultaneously decreasing the number of workers needed, and raising the skill levels required of the remaining workers. Even though the American auto industry has largely recovered from decades of decline, and in the case of General Motors and Chrysler, bankruptcy, the millions of jobs that automobile assembly lines once provided are not coming back.

This is a broad-ranging and excellent survey of a century of industrial history, in which electrification played an essential role, and thus is highly recommended to readers of this newsletter.

## 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, chauffeur 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](http://www.amazon.com/Bell-Labs-Memoirs-Innovation-Geselowitz/dp/1463677979/ref=sr_1_1?s=books&ie=UTF8&qid=1320151019&sr=1-1)

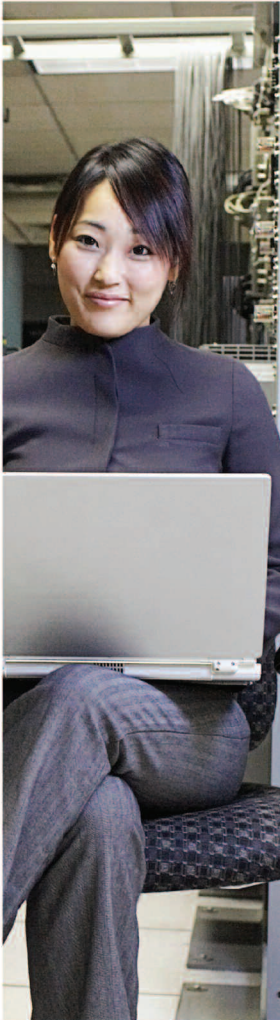
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