# IEEE

# IEEE History Center

## SERVING THE PUBLIC; SERVING THE PROFESSION



*Attendees of the Weston Meters Milestone Dedication view the Weston Collection
at the New Jersey Institute of Technology*

## STEVENS
INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY

# SIGNALS FROM THE DIRECTOR

By Michael Geselowitz, Ph.D.

I hope all of you, our loyal readers and supporters, had a good summer in the northern hemisphere (and a not unpleasant winter in the southern hemisphere). The hot summer doldrums often usher in a slow period in the U.S., Canada, and Europe, and as the autumn arrives, so do other vagaries of the weather (Hurricane Matthew forced the IEEE History Committee meeting from Miami, Florida, into a web conference format, an unprecedented occurrence!). However, I think a glance at this issue will convince you that, despite the climate, the IEEE History Center, guided by the IEEE History Committee, has been hard at work since my last report.

The IEEE Milestones in Electrical Engineering & Computing Program (see p. 5) continues its fantastic growth. I was honored to be included as a speaker at one of the many recent Milestone dedications, that of "Weston Meters, 1887-1893," held at the New Jersey Institute of Technology in Newark, New jersey, USA, on 23 September (see cover photo). Center historian Dr. Mary Ann Hellrigel spoke as well. The ceremony was organized by IEEE past president Dr. Moshe Kam, who serves as the Dean of the Newark College of Engineering of NJIT, and

## 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 Engineering & Technology History Wiki, Milestones, and Oral History Collection, please click on **www.ieeefoundation.org/donate_history**

# 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, and 2 October.
For more information, contact Robert Colburn at **r.colburn@ieee.org**.

featured the unveiling of the plaque by IEEE President Barry Shoop, as well as a tour of NJIT's Weston Collection. Many members of the IEEE North Jersey Section and of the NJIT community were in attendance, and importantly, Dean Kam was also able to involve NJIT students. It was exciting to see young people become interested in the giants on whose shoulders they stand. Edward Weston, though often overlooked today, was certainly one of those giants (and a founder of NJIT).

The Oral History program also continues to expand. The addition of the second round of superconductivity interviews brings the total collection very close to 800 interviews of prominent participants in IEEE's fields of interest.

The Engineering & Technology History Wiki, which is the repository for our oral histories and so much more, continues to average more than 3,000 sessions per day. An exciting new content project for the ETHW is described on page 4.

Over the summer, History Center staff and History Committee volunteers participated in the annual meeting of the Society for the History of Technology, which had moved from its usual autumn time frame in order to relocate from its usual North American or European venue to Singapore.

Finally, the REACH program continues to gain momentum. In the June issue, we reported on our first successful piloting of a unit, on maritime navigation. We had already been accepted to present on REACH at the annual meeting of the National Council for the Social Studies (NCSS) in Washington, DC, in December. The success of the pilot, and of an educator workshop at the Intrepid Sea, Air & Space Museum in July, has also gained us a rare invitation to present to the meeting of the State Social Studies Specialists, which is held in conjunction with NCSS. In the meanwhile, other units in the pipeline include Greek triremes, the printing press, and broadcast radio. The beta version of the website will be ready by the end of the year. Look for a lot more exciting REACH news in the March 2017 newsletter.

These programs and everything else we do are enabled by the generous contributions of you, our loyal donors. This column represents my last opportunity of the year to once again thank you, and to ask you to think of us once again when you renew your IEEE membership, submit your IEEE Life member profile, or consider your end-of-year philanthropic options. Let me also take the opportunity to wish you and yours a happy holiday season, and a healthy and fulfilling new year.

## SERVING THE PUBLIC; SERVING THE PROFESSION

## IEEE HISTORY SINCE 1984 BOOK PROJECT UPDATE

In April 2016, the IEEE History Center engaged Andrew J. Butrica (author of *IEEE Life Members Committee History*) to research and write a history of IEEE from the mid-1970s to the present. This project continues the story begun in two books published by IEEE in 1984 to mark its centennial, including *The Making of a Profession: A Century of Electrical Engineering in America* by A. Michael McMahon, (text available online at **http://ethw.org/images/e/ee/The_Making_of_a_Profession.pdf**) and John D. Ryder and Donald G. Fink's Engineers and Electrons (**http://ethw.org/images/c/cc/Engineers_%26_Electrons.pdf**). The book will be published on the Engineering and Technology History Wiki website **http://ethw.org/**.

History Committee member John Vig raised the funds for

this project and has assembled an advisory committee tasked with reviewing and commenting on the manuscript. The advisory committee is an Ad Hoc committee of the History Committee and includes John Vig, Irv Engelson, Dick Gowen, Eric Herz, Juan Carlos Minguez, Roland Saam, and Steven Weinstein.

By October, Butrica had submitted the first draft of material which will serve as two introductory chapters. He is using records from the IEEE Archive and the IEEE History Center's Oral History Collection. The IEEE History Center asks anyone who may have collected important IEEE documents, reports, etc. that may be useful for this project to please contact Mary Ann Hellrigel, Institutional Historian at the IEEE History Center by either email **m.c.hellrigel@ieee.org**, or phone (732) 562-6834.

## RADIO ANCESTORS: NEW ARCHIVAL TEXTS ON ENGINEERING AND TECHNOLOGY HISTORY WIKI

The Engineering and Technology History Wiki (ETHW) was launched in January 2015 as a partnership between IEEE and six other major engineering societies to document the history of all disciplines of engineering and technology. The IEEE History Center has located three unpublished works of IRE and radio pioneers Robert Marriott and Haraden Pratt, and posted them on the ETHW.

Robert Marriott's memoir "Radio Ancestors" spans 647 pages, and details in great length his career, involvement with IRE, and the trajectories of radio technologies. Written in 1937, it provides a fascinating firsthand look into the climate surrounding wireless technologies at the beginning of the 20th century.

Two texts from Haraden Pratt, "Sixty Years of Wireless and Radio Reminiscences" and "Autobiographical Notes", written in the late 1960s, have also been posted on the ETHW. Combined, the two documents form an interesting account of Pratt's life and career.

These three documents, as well as all other archival books and articles posted on the ETHW can be viewed on the Archival Publications page:
**http://ethw.org/Archives:Books_and_Archival_Publications**

## HISTORY CENTER HELPS TWO STUDENTS WIN NATIONAL HISTORY DAY CHAMPIONSHIPS

Last winter and spring the History Center assisted two middle school students with their projects for National History Day (**https://www.nhd.org/**), a United States-based program for engaging middle and high school students in developing their historical research and presentation skills. More than half a million students compete in nine categories on the annual theme, which this year was "Exploration, Encounter, Exchange in History." The center's advice and suggestions seem to have helped, for Anika Kapoor and Drake Bolt won their respective categories at their state championships and were among the 3,000 qualifiers who traveled to College Park, Maryland, in June for the national contest.

Anika won the individual documentary category in New Jersey for "The Wizard of Menlo Park Casts a Spell Upon Our Ears: Thomas Edison's Phonograph and the Evolution of Sound

*Drake Bolt*

*Anika Kapoor*

Recording," for which outreach historian Alex Magoun agreed to be interviewed at the Princeton Record Exchange on the history and persistence of analog records. Drake won the individual website category in California for "Nikola Tesla: The Shocking Exploration, Encounter, and Exchange of the Electrical Wizard," for which Magoun and institutional historian Mary Ann Hellrigel provided interviews and references. Drake went on to place fourth in the nation and receive one of two California medals for Outstanding Project. His Tesla website is now at **http://nikolatesla-drakebolt-nhd2016.weebly.com/**. Although Anika did not place at Nationals, she showed her documentary at a board meeting of the New Jersey Historical Commission.

The IEEE History Center congratulates both young historians on their outstanding work!

## RECENT STAFF PUBLICATIONS

"Edison, the Electrical Engineer, Spearheaded Central Station Business" by Mary Ann Hellrigel, *IEEE Insight* **http://insight.ieeeusa.org/insight/content/views/327089**

"The Tesla Almost Nobody's Heard Of: Frank Fowle and Alternating Current Transposition" by Robert Colburn, *IEEE Insight* -- **http://insight.ieeeusa.org/insight/content/views/339991**

"What the Public Knew about Wireless before Titanic" by Alex Magoun, *Proceedings of the IEEE,* August 2016, pp1662-1668, **http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7515260**

"Going Rogue: A Brief History of the Computerized Dungeon Crawl" by Nathan Brewer, IEEE Insight, **http://insight.ieeeusa.org/insight/content/views/371703**

Outreach Historian Dr. Alex Magoun also helps edit the monthly Scanning Our Past articles in Proceedings of IEEE **https://www.ieee.org/publications_standards/publications/proceedings/proceedings_of_the_ieee.html**

The many articles and books written by IEEE History Center staff are highlighted on the newly-formatted page on the ETHW: **http://ethw.org/Archives:Books_and_Archival_Publications**. The page provides links to some of our "greatest hits" measured by readership statistics and publication reach. We invite you to browse; we hope to surprise you with the breadth of interesting topics we've explored.

# GERMANY'S FIRST BROADCAST DEDICATED AS THE 169TH IEEE MILESTONE IN ELECTRICAL ENGINEERING AND COMPUTING

By Gerhard Roledaer

IEEE's Milestone program dedicated its 169th milestone on 16 July 2016. Commemorating Germany's First Broadcast Transmission from the radio station Königs Wusterhausen on 22 December 1920, the plaque was unveiled in the Sender-und Funktechnikmuseum by IEEE President Dr. Barry L. Shoop. The Milestone plaque is on display in the former Senderhaus 1, now a museum. The dedication ceremony was accompanied by messages from special guests: State Secretary Martin Gorholt and CTO of Media Broadcast GmbH Frank Schulz. Presentations given by Prof. Wolfgang Mathis (Leibniz University Hannover) and journalist Katharina Gerlach described in a wider sense the circumstances of the wireless telephony test in the Königs Wusterhausen radio station.

The test transmissions began in early 1920. Employees of the radio station upgraded a 5 kW arc transmitter with a modulation circuit to transmit voice and music. The so-called Christmas concert is regarded as the birth of statutorily regulated broadcasting in Germany. Soon after, more concerts followed and public broadcasting took root in Germany. **museum.funkerberg.de/meilenstein** (English available)

For information about the IEEE Milestone Program, and how to propose technical achievements as IEEE Milestones, please see **http://ieeemilestones.ethw.org/Milestone_Guidelines _and_How_to_Propose_a_Milestone** .



# DO YOU HAVE MILESTONE PLAQUE SELFIE PHOTOS YOU WOULD LIKE TO SHARE?

Today there are more than 170 IEEE Milestone plaques mounted at historic locations on six continents. Each represents a technical accomplishment of regional, national, or global importance, proposed by an IEEE member, sponsored by an OU, reviewed by the IEEE History Committee, and approved by the Board of Directors. How many have you seen? Send or text your Milestone selfies to **ieee-history@ieee.org** with the message line, "Milestone Selfie for posting." The IEEE History Center, which administers this popular grass-roots IEEE program, will post them in the Engineering and Technology History Wiki's Milestone Selfie Gallery **http://ethw.org/Milestones:Milestones_selfies** and share them on Twitter's @IEEEHistory **http://twitter.com/ieeehistory** and the IEEE History Center's Tumblr account **http://engineeringhistory.tumblr.com/** For a map of IEEE dedicated Milestones, click on the ETHW's Innovation Map at **http://ethw.org/Map**

# TV TOWERS IN IEEE REGION 8

By Anthony C. Davies, Emeritus Professor,
King's College London, England

In order to achieve national and/or long distance broadcasting coverage, a variety of structures have been used. Guyed masts and self-supporting towers of many shapes have been built, and in some cases the towers have been designed to include restaurants and viewing galleries, or other means of attracting the public or encouraging tourism. Some have also become targets for terrorists, which has in some cases led to prohibition of public access.

A wide variety of designs for TV towers can be seen around the European part of IEEE Region 8, and some have become associated with important historical and political events. They are now increasingly used for multiple telecommunications services, including point-to-point microwave links and general mobile telecommunications, and the antenna-designs have typically become more complex because of the need to handle digital multiplexed broadcasts, replacing the previous analogue TV transmissions.

**Berlin, Germany:** *Fernsehturm,* built 1965-1969 during the time of the German Democratic Republic (East Germany) at Alexanderplatz, when the authorities forcefully discouraged all religious beliefs, this tower acquired the nickname 'The Pope's Revenge' because when the sun shines on the shiny sphere, a reflection reminiscent of a Christian cross is seen. The reflection can be clearly seen in Figs. 1 and 2, while Fig. 3 shows the huge supporting base.
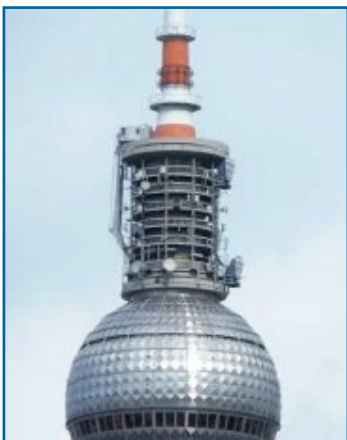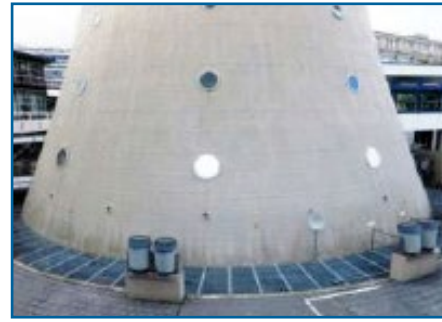


*Fig. 3*

**St. Petersburg, Russia:** The TV tower was built in 1962. It is a lattice construction, with a height of 326 m, and includes an observation platform (Figs. 4, 5, 6).   During a visit in the early 1990s, well after the end of the Soviet Union, and the renaming of Leningrad as St. Petersburg, I enquired about the transmission frequencies used, and was told that the location and the transmission frequencies are officially secret and cannot be divulged. Nevertheless, the tower is easily visible from most parts of the city, and of course to receive the TV transmissions, it is necessary to know the frequencies used!



*Fig. 4*



*Fig. 1*



*Fig. 2*



*Fig. 5*



*Fig. 6*

**Vilnius, Lithuania:** Figs. 7 and 8 show the 326 m TV tower, built in the 1974-1980 period of the Lithuanian Soviet Socialist Republic. The base is the location of the Radio and TV broadcasting studios. It was the location of a confrontation between Lithuanian nationalists and the Russian military forces in January 1991, when thirteen Lithuanian civilians were killed and

many injured. The tower includes a slowly rotating observation gallery and café at a height of 190 m.



Fig. 7



Fig. 8

**Riga, Latvia** also has a distinctive TV tower, which at 368 m is the tallest building in the European Union countries. For comparison, the Shard in London is 310 m, the Eiffel Tower in Paris is 300 m and the Empire State Building in New York is 443m if the antenna on top is included. Construction of the Riga TV tower started in 1979 and took ten years. It is on an island in the River Daugava. Elevators for access are in the legs.  Fig. 9 shows a distant view and Figs. 10 and 11 show parts of the tower.
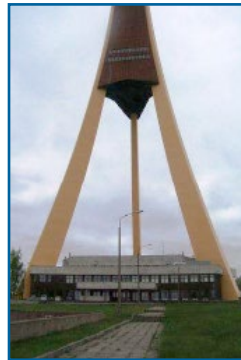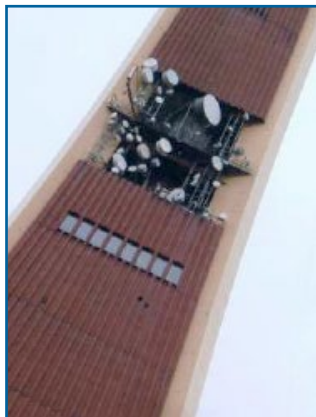
**Prague, Czech Republic:** The Žižkov TV tower, built 1985 – 1992, also has three supporting legs. One of the legs extends upwards to become the main antenna structure (Figs. 12, 13, 14). It is 216 m in height, and is on a hill looking over Prague, providing additional height. Initially, it acquired a number of derogatory nicknames, which could not be mentioned during the Communist era, of course.



Fig. 12



Fig. 13



Fig. 14

**Sofia, Bulgaria** has the 186 m Kopitoto TV tower on the Vitosha mountain, looking down over the Sofia Valley.  It commenced operation in 1985.



Fig. 9



Fig. 10



Fig. 11



Fig. 15



Fig. 16



Fig. 17

The concrete Kopitoto tower replaced the old TV tower at Borisova Gradina (Figs. 18, 19, 20), in the outskirts of Sofia, which is now used for a variety of telecommunications services.


*Fig. 19*


*Fig. 18*


*Fig. 20*

**Madrid, Spain:** The Torrespaña is 231 m tall and began operation in 1982. It has the nickname "El Piruli" because of its similarity to a lollipop of this name popular in the past.


*Fig. 21*   *Fig. 22*   *Fig. 23*

**Amsterdam, Netherlands:** The KPN tower in Amsterdam is to the South of the city, alongside the RAI convention centre. The original structure, built in 1963, did not include the upper section of oval platforms and mast, added in 2008, increasing its height to 146 m. This exceeds the normally-permitted height of buildings in this area, which is restricted because of the proximity to Schipol airport. The tower has the special function of disaster-transmitter, to maintain services in the case of a major calamity shutting down all other facilities.


*Fig. 25*


*Fig. 24*
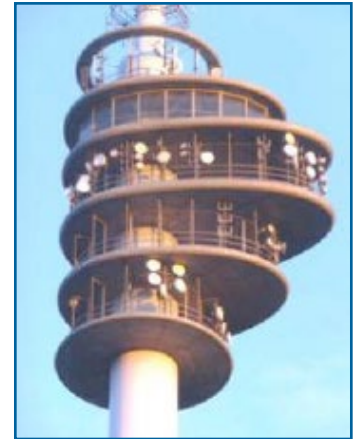

*Fig. 26*

The TV towers illustrate a variety of different approaches to the problems of providing a high-altitude platform for TV and radio antennas for broadcasting. The privatisation of nationally owned broadcasting services in many European countries has often led to the towers being used for multiple additional telecommunications services and different functions. For example, the Žižkov tower now contains a one-person hotel!

*All photos were taken by the author. Various engineers and IEEE members are thanked for the opportunities to visit several of these TV towers and for the provision of conducted tours for myself and colleagues at various times.*

# FELLOWSHIP AND INTERNSHIP 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 campus of Stevens Institute of Technology in Hoboken, New Jersey, USA; there is no residency requirement for the dissertation fellowship.

### The IEEE Life Member Fellowship in the History of Electrical and Computing Technology

The IEEE Life Members Fellowship in the History of Electrical and Computing Technology 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 $1,000 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 the book version of 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 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/about/history_center/fellowship.html**. The deadline for completed applications is 1 February. This completed application packet should be emailed to **ieee-history@ieee.org** or mailed to the Chair, IEEE Fellowship in the History of Electrical and Computing Technology Committee, IEEE History Center at Stevens Institute of Technology, Samuel C. Williams Library, 3rd Floor, 1 Castle Point on Hudson, Hoboken, NJ 07030-5991   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 Stevens Institute of Technology campus in Hoboken, New Jersey, USA.

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 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 the United States.

The stipend paid to the intern is US$5,000, 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, and the stipend was recently increased thanks to a generous gift from Emerson Pugh .

There is no formal application form. To apply, please mail curriculum vitae showing their studies in electrical history or related field, a three- to five-page page (single or double spaced) writing sample, 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 Stevens 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 Stevens Institute of Tech-

nology. 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, Stevens Institute of Technology, 1 Castle Point on Hudson, Hoboken, NJ 07030-5991, +1 732 562 5450, **ieee-history@ieee.org**, **http://www.ieee.org/about/history_center/index.html**.

## LINDA HALL LIBRARY SEEKS FELLOWS AMONG SCIENCE, TECHNOLOGY HISTORIANS

The Linda Hall Library is accepting applications for its 2017/18 Fellowship program. The fellowships, lasting from one week to a full year, are awarded to projects in history of science, environmental history, and related science and technology studies fields that use the Library's collections. The Fellowships include a monthly stipend.

The Linda Hall Library, located in Kansas City, Missouri, USA, is among the world's leading independent research libraries, with extensive sources related to environmental sciences, physical sciences, earth sciences, engineering, and the life sciences. The Library holds 500,000 monograph volumes and more than 48,000 international journal titles, with especially strong holdings in Soviet and East Asian science. The collections includes conference proceedings, government publications, technical reports, and over 200,000 industrial standards.

For more information and to apply online by January 16, 2017, visit: **http://www.lindahall.org/fellowships**.

## OBITUARY

## ARPANET PIONEER AND ACOUSTIC ENGINEER LEO BERANEK
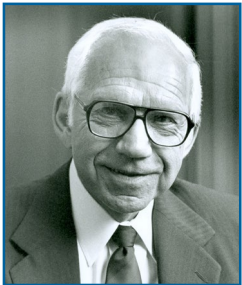
The IEEE History Center lost a loyal supporter with the death at 102 years of age of Leo Beranek on 10 October 2016. Beranek **http://ethw.org/Leo_L._Beranek** was famous as an acoustic engineer, and most especially as the president of the firm Bolt, Beranek, and Newman, which built the Interface Message Processors which connected the first nodes of the ARPANET. The first message between two IMPs was sent in September 1969. Two IEEE Milestones in Electrical Engineering and Computing celebrate the work on ARPANET —Birthplace of the Internet **http://ethw.org/Milestones:Birthplace_of_the_Internet,_1969 and Inception of the ARPANET.** **http://ethw.org/Milestones:Inception_of_the_ARPANET,_1969**

## BIBLIOGRAPHY

### GROSS, BENJAMIN,
*The Mother of All Demos,* Linda Hall Library

Where does the story of modern computing begin? For some, it starts with Charles Babbage and his difference engine, while others might point to the Harvard Mark I or ENIAC. Yet as significant as those machines were, they bear little resemblance to today's personal computers. To understand the origin of your laptop, composers Mikel Rouse and Ben Neill argue, one must look to December 1968, when SRI electrical engineer Douglas Engelbart demonstrated a prototype office workstation to an audience in San Francisco. This "Mother of All Demos" showcased several now-familiar features of everyday computing, including a text editor, hyperlinks, and a new form of pointing device called a "mouse."

Rouse and Neill have transformed Engelbart's now legendary presentation into *The Demo*, a multimedia theatrical piece which premiered at Stanford University in 2015 and was recently staged at the University of Kansas's Lied Center. Equal parts historical reenactment, performance art, and synthesizer concert, *The Demo* reinterprets the 1968 presentation, with Rouse standing in for Engelbart and Neill playing the role of his assistant William English.

As historical footage from the original demonstration plays on a screen behind them, Rouse and Neill remix the audio and insert new images hinting at the origins and implications of Engelbart's ideas—everything from magnetic tape computer memories to the World Wide Web. They also add a techno-inspired soundtrack, whose booming bass and drum beats are complemented by Neill's occasional solos on the "mutantrumpet"—an electro-acoustic brass instrument of his own invention.

The resulting spectacle is a mesmerizing reflection on the novelty of what Engelbart showed the crowd on that fateful day in 1968. To us there is nothing particularly exciting about editing a grocery list using a computer, but Rouse and Neill reframe it as a transcendent experience, hinting at the many future documents waiting to be composed on future word processors. Those anticipating a strict recreation of the Mother of All Demos may be disappointed by Rouse and Neill's reinterpretation, but if the audience at the Lied Center was any indication, people are more likely to leave inspired to reflect upon the history of computing and how much our devices have changed since Engelbart first took the stage.

## FROM THE IEEE HISTORY CENTER PRESS

### *SPRAGUE ELECTRIC: AN ELECTRONIC GIANT'S RISE, FALL, AND LIFE AFTER DEATH*
by John L. Sprague
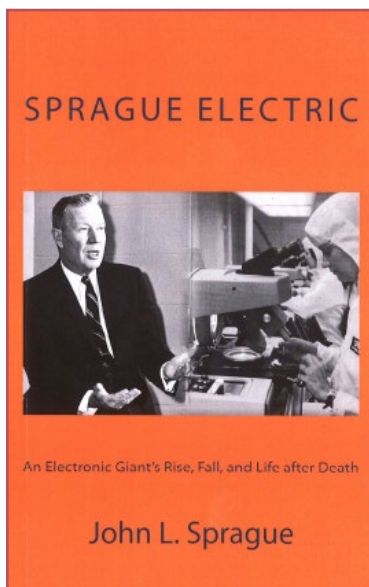
The rise of the Sprague Electric Company from a high-tech kitchen-table startup is representative of much of the U.S. electronics industry. Sprague Electric began in 1926 in the Quincy, Massachusetts kitchen of a young naval officer, Ensign Robert C. Sprague, and became a thriving manufacturer employing thousands of workers. Its broad product line of electronic components achieved international sales and a reputation for the highest quality. There were more than 50,000 Sprague components on every *Apollo* mission, and more than 25,000 aboard every Space Shuttle. The company later declined, went through a series of acquisitions, and eventually dissolved.

*Sprague Electric* provides a valuable business and technological history, a story of corporate success, and a cautionary tale of what to avoid. Told by company insider John Sprague, *Sprague Electric* gives the reader a front-row seat.

The *Sprague Electric* story reveals the value of investment in research and development, and also the effects of raw material supply chains on product lines. It is a story of a company's relations with the small New England mill town of North Adams, Massachusetts where its factories were located, and how labor relations — initially cordial— later soured. It is a story of how a vulnerable company weathered the stresses of the Great Depression and triumphed, only to be brought down by the recessions of the 1970s and 1980s.

It is a history of acquisitions, mergers, and spin-offs— some of them botched— and of the strategic and tactical mistakes that eventually caused the company to vanish. Yet, *Sprague Electric's* successor companies continue its legacy in the electronic components industry. Corporations formed from its different business units and operations are now located around the world. The principal manufacturing plant of Sprague Electric is now an acclaimed art museum.

Available from **Amazon.com** in hard copy and on Kindle.

http://www.amazon.com/Sprague-Electric-Electronics-Giants-after/dp/150338781X/ref=sr_1_2?ie=UTF8&qid=1429202871&sr=8-2&keywords=sprague+electric

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## HAIGH, THOMAS, MARK PRIESTLY AND CRISPIN ROPE,
*ENIAC in Action: Making and Remaking the Modern Computer,* MIT Press, Cambridge, 2016
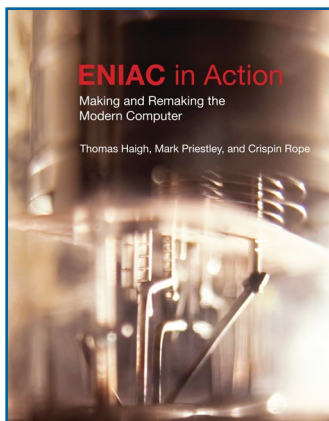
*ENIAC in Action*, laid out in twelve chapters, provides a "fundamental reassessment" of ENIAC as a scientific instrument of great historical significance. It addresses a wide range of topics including: ENIAC as a machine of war, the "first computer," a material artifact continuously modified by its users, a site of technical analysis, the subject of contested histories, and an object of contested historical memory and folklore. It is also part of a "… broader re-engagement of historians with the specifics of computer technology and the concerns of computer science." (p. 13) In addition, *ENIAC in Action* "re-integrates technical detail into history influenced by the perspectives of science studies, labor history, institutional history, memory studies, and gender history [because there is] …no essential boundary between the 'social perspectives and …"technical" analysis." (p, 14)

The familiar history of ENIAC (Electronic Numerical Integrator and Computer), the first general-purpose programmable electronic computer, includes three key benchmarks: conceived in 1943, completed in 1945, and decommissioned in 1955. Then during the era spanning from the 1950s into the 1970s, ENIAC was kept in the news as lawyers argued over "who invented the computer" and the validity of the patent filed on 26 June 1947. The patent suits created much documentation, perhaps quite biased, for the period from 1943 to 1946. By the 1970s, the legal files were complemented by memories and oral histories of the pioneers who worked on the machines in the 1940s and 1950s; many with vested interests in the outcome of the patent litigation cases. These early computer historians were joined the next decade by professionally trained historians penning Ph.D. dissertations.

The authors of this book jumped into this breach to write a more accurate, informative, and contextual history; a more historically significant and important tale. How was this possible? The authors asked "different and better questions," used different sources (many underused primary sources), and honed in on what they believe is the real story. They claimed to be most

**11**

interested in questions of use and practice, focusing on computer technology, mathematical practice, computational capabilities, and the concerns of computer science. They wrote "about how and why a small group of mathematicians, scientists, engineers, and Army administrators came together to propose, authorize, and design the unusual machine. It is also about the women and men who built, programmed, and operated ENIAC, and about the uses scientists found for all those millions of multiplications." (p. 1)

*ENIAC in Action* tells a more complete and contextual story of ENIAC from its design, construction, testing, and use to its afterlife as part of computing history. While it incorporates considerable technical detail about the actual machine, both hardware and software, it remains highly readable even for those with limited knowledge of computer science and engineering. At times the text is quite lively, and perhaps a bit snarky, commenting on perceived misconceptions, mistakes, and omissions and highlighting the neglected years, 1947 and 1948 ,as well as underappreciated details. For example: "Attempts by historians to appropriate from theoretical computer scientists the concept of universality and a determination to treat the 'stored program concept' as if it were a single, precisely definable feature of a computer have pushed the dominant discourse of early electronic computing into a swamp of pointless bickering and misunderstanding." (p. 256)

Ultimately, *ENIAC in Action* is an engagingly written and well-organized revisionist history that also puts the technology into the history of computing. It is an essential contribution to the MIT Press History of Computing Series.

Pertinent additional supporting technical material may be found at the following website: *ENIAC in Action:*
**http://eniacinaction.com/the-book/supporting-technical-materials/**

Available from The MIT Press, Cambridge, MA. (800) 405-1619; fax: (800) 406-9145; e-mail: **orders@triliteral.org**, **mitpress-orders@mit.edu**; **https://mitpress.mit.edu/**; $38.00, hardcover, ISBN: 9780262033985, 360 pp., 43 b&w illustrations, Feb. 2016. Also available as an E-book, $27.00, ISBN: 9780-262-33441-9, April 2016.

## MOORE, GRAHAM,
### *The Last Days of Night*, 2016
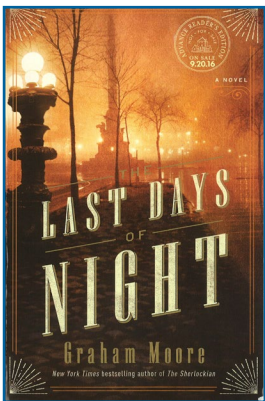
*Guest Review by Dr. Emily Schneider*

In novelist and screenwriter Graham Moore's *The Last Days of Night*, the author tries to engage the reader in the legal and psychological combat between Thomas Edison and George Westinghouse as they struggle to win a patent battle over the light bulb and the AC vs. DC "current wars." This attempt, largely successful, features the central character of Paul Cravath, a young lawyer launching his career in turn-of-the century New York City, and his related pursuit of a calculating and yet vulnerable young woman who befriends the eccentric Nikola Tesla. His novel largely succeeds in its ambitious scope, even making the general reader care about the difference between cotton, bamboo, and platinum filaments.

Moore's novel traces the career of Cravath as he struggles to succeed professionally while litigating the dispute between Edison and Westinghouse over who actually "invented" the light bulb. The character of Cravath is based on a historical figure, although many events in the narrative are invented or substantially changed. Intertwined within the novel are scientific and moral questions. What constitutes invention? Edison always seems ahead of his adversaries as he deflects accusations that the timeline of his actual inventions does not align with the information in his patent applications. When Cravath tries to argue in New York State Court that electrical current may not be used as a tool of execution, the novel boldly tries to integrate scientific and moral issues. Moore deliberately uses tabloid descriptions typical of the era's press as he relates the terrible fate of the convicted prisoner; it seems that the legal system has failed to respond to the challenge of using technology to inflict suffering.

And then there is Nikola Tesla. The novelist highlights the psychological idiosyncrasies of the brilliant scientist who will only eat saltines and who seems to have a childlike attachment to the brittle and ambitious Agnes Huntington. Ultimately, however, Tesla is something of a hero, as Moore invents a role for him educating aspiring African-American scientists at Fisk University, an institution with which the real-life Cravath family was involved as benefactors.

Any historical novel will combine fact and fiction; this practice defines the genre. Graham Moore's ambition in *The Last Days of Night* is significant. The focus of his historical recreation is the role of technology in a changing world. We witness electrification as it illuminates New York City and as it incinerates a helpless utility worker in front of New York pedestrians. The novel also explores the lonely and insecure Paul Cravath as he struggles to balance financial success and ethical integrity, and his romantic aspirations. In his depiction of Cravath's unlikely pursuit of Agnes, a celebrated performer whose own past is as compromised as that of the financial and intellectual luminaries who control Cravath's life and career, Moore succeeds in creating a sympathetic and nuanced character. While Moore's characterization of Edison is particularly villainous, and Tesla is presented as an innocent genius incapable of negotiating his way through the "current wars," *The Last Days of Night* ultimately engages the reader through the circuitous currents of late nineteenth century technology and the lives of its most famous luminaries.

Available from Random House, New York, NY, **www.randomhousebooks.com**, $16.80, hardcover, ISBN: 0-812-98890-6, 384 pages.

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