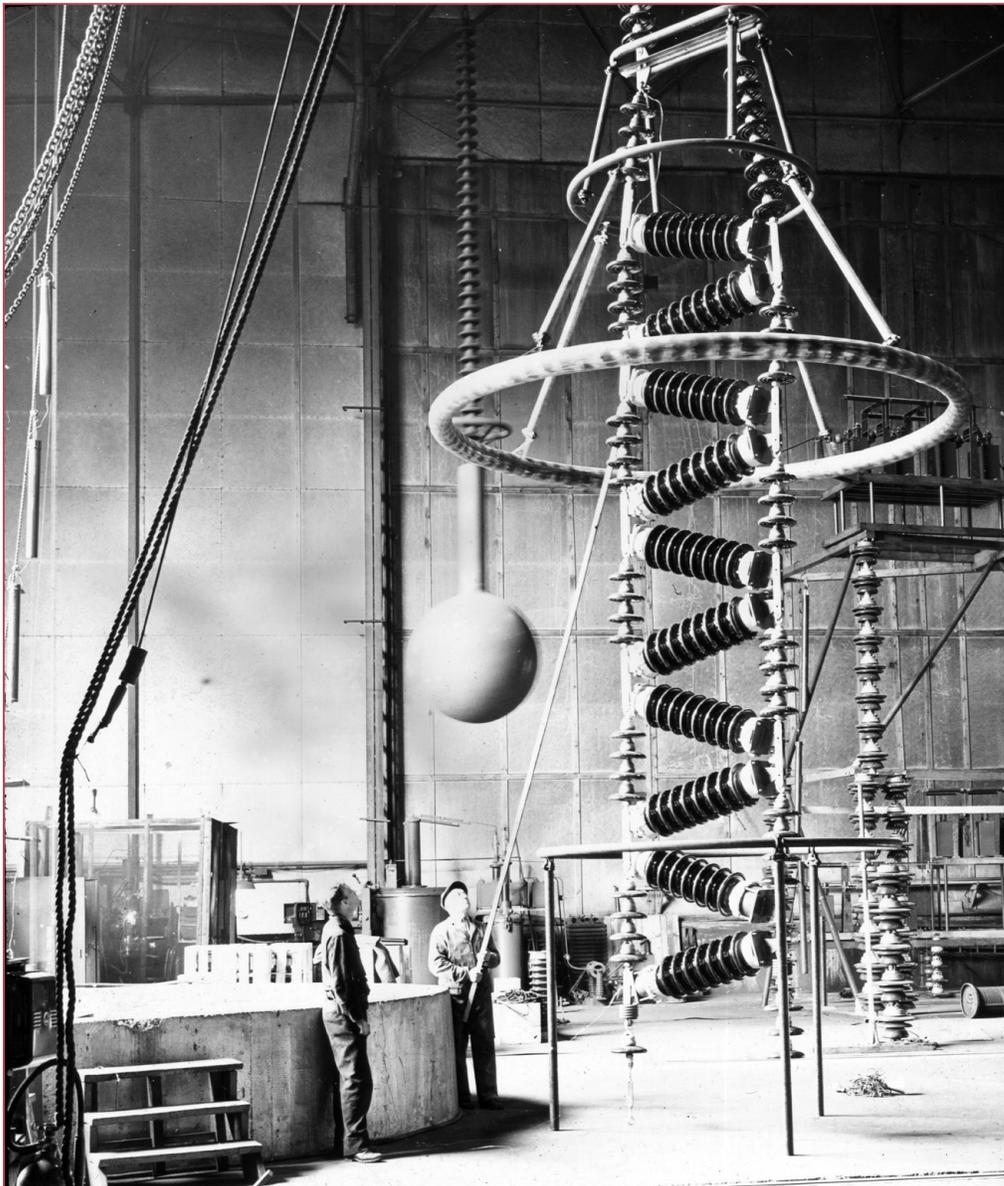


IEEE History Center

ISSUE 120, November 2022

GLASS LANTERN SLIDES, NEW SOUTH WALES SECTION 50TH ANNIVERSARY, AND GHOSTS OF TROLLEYS



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*Shown left is just one of the spectacular
Bellaschi glass lantern slide collection of
power-related images that the History
Center has recently digitized.*

Story on page 5

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 (July) and twice electronically (March and November) by the IEEE History Center.

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Well-read Australian magpies rely on the History Center Newsletter to keep them up to date on IEEE's history activities. Image courtesy of David Burger.

Dr. Michael Geselowitz
Senior Director, IEEE History Center

This issue of the IEEE History newsletter highlights our return to the IEEE Operations Center, which I first reported in my July column. It also welcomes our newest staff member, Dr. Daniel Mitchell (see page 5). Daniel will be spearheading our newest program, the IEEE Global Museum.

As I always do in the last newsletter of the year, I would like to take this opportunity to express my gratitude to you, our loyal donors, for your ongoing support and encouragement of all of our activities that further the preservation and dissemination of information about the proud heritage of IEEE and its fields of interest. The projects highlighted in this issue—the aforementioned IEEE Global Museum, the IEEE REACH Program, the IEEE Archives, and the Engineering & Technology History Wiki—as well as our other outreach activities such as IEEE Milestones, presentations, and publications, are all made possible by the guidance of the IEEE History Committee and by your generosity.

So, thank you again, and I wish you and yours a happy holiday season and a safe, healthy, satisfying, and prosperous new year.

HOW CAN THE HISTORY CENTER HELP YOU?

A Handy Guide to Some of Our Programs and Contacts

Engineering & Technology History Wiki: https://ethw.org/Main_Page

List of dedicated IEEE Milestones: https://ethw.org/Milestones/List_of_Milestones

How to Propose an IEEE Milestone: http://ieemilestones.ethw.org/Milestone_Guidelines_and_How_to_Propose_a_Milestone

Milestone proposals in process: http://ieemilestones.ethw.org/Milestones_Status_Report

Oral History Collection: https://ethw.org/Oral-History/List_of_all_Oral_Histories

REACH Program (free online materials for teaching the history of technology): <https://reach.ieee.org/>

History Events Calendar: <https://www.ieee.org/about/history-center/events.html>

Support for scholars:

Fellowship in the History of Electrical and Computing Technologies:

<https://www.ieee.org/about/history-center/fellowship.html>

Pugh Young Scholar in Residence:

<https://www.ieee.org/about/history-center/internship.html>

Middleton History Prize (awarded to a book in the history of technology):

<https://www.ieee.org/about/history-center/middleton-award.html>

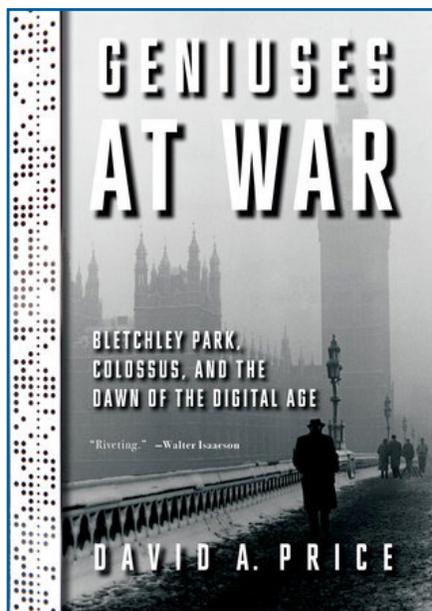
The IEEE History Center Newsletter welcomes submissions of letters to the editor, as well as articles for its **Reminiscences** and **Relic Hunting** departments. "Reminiscences" are accounts of history of a technology from the point of view of someone who worked in the technical area or was closely connected to someone who did. 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.

GENIUSES AT WAR BY DAVID PRICE WINS 2022 MIDDLETON PRIZE

The IEEE History Committee has chosen *Geniuses at War: Bletchley Park, Colossus, and the Dawn of the Digital Age* by David A. Price for the 2022 William and Joyce Middleton Electrical Engineering History Award.

Drawing upon recently declassified sources, Price's book tells the dramatic, story of the brilliant team whose feats of innovation and engineering created the world's first, digital, electronic computer. This enabled decryption of the Nazis' toughest code, helping bring an end to WWII, and helped usher in the information age. <https://www.penguinrandomhouse.com/books/575581/geniuses-at-war-by-david-a-price/>

The Awards Subcommittee of the IEEE History Committee appreciated Price's skill in exploring and explaining key episodes in



the early history of computers and of WWII British operations in codebreaking. Price's work should attract a wide audience of readers.

The William and Joyce Middleton Electrical Engineering History Award, established in 2014 by a gift from the estates of long-time IEEE leader William W. Middleton and his wife Joyce F. Middleton, recognizes annually the author of a book (published within the previous three years) in the history of an IEEE-related technology that both exemplifies exceptional scholarship and reaches beyond academic communities toward a broad public audience. It carries a prize of US\$2,000. <https://www.ieee.org/about/history-center/middleton-award.html#about-the-award>

IEEE HISTORY ACTIVITIES AROUND THE WORLD

IEEE NSW SECTION CELEBRATES ITS 50TH ANNIVERSARY

On the 16th of August 2022, the IEEE New South Wales Section celebrated 50 years since its formation in 1972. A gala Anniversary dinner was held as a centre piece of these celebrations. The Section was originally called the Australian Section but with the formation of Sections in other states of Australia, it was renamed the NSW Section because it was formed in the state of NSW. The Australian sections came together to form the Australia Council.

As part of the celebration of 50 years of operation, the IEEE NSW Section had a new banner produced to announce its golden anniversary (see Fig. 1).

Another activity was the production of a booklet which summarises some of the history of the Section and major events that have taken place over the 50 years. Fig. 2 shows the front cover of this booklet [1].

The story of how the IEEE Australian Section came to be formed, has been related in the past by Jim Vasseleu, who organised the petition for the establishment of the Australian Section.

After Jim had become an IEEE member, he received an IEEE member lapel badge. One day when he was attending an electrical engineering function in Sydney, he got talking to an



Figure 1: 50th Anniversary banner of the NSW Section.



Figure 2: Front cover of the 50th Anniversary booklet [1].

electrical engineering colleague who noticed his badge. After some discussion, the two decided that it would be good to form an IEEE Australian Section. Jim then organised an inau-

gural meeting of IEEE members, at which it was agreed that a petition be sent to IEEE Headquarters for the formation of an Australian Section.

This inaugural meeting took place in 1972 at the historic Cellblock Theatre of the National Art School in Darlinghurst, a suburb of Sydney. Shortly afterwards, the 1972 IEEE President, Dr Robert Tanner, made a formal visit to Australia and met with the signatories. After permission to form the Australian Section was granted, the first meeting was held at Neutral Bay Junction on 12 September 1972, when Jim Vasseleu was elected the first Section Chair, Len Clementson Vice Chair and James Deans Secretary/Treasurer. By the 12th of October 1972, the IEEE Australian Section By-Laws had been formulated and endorsed.

By 1984, the Centenary year of IEEE, the IEEE Australian Section membership had grown over five-fold since its inception. The combined total of the Australian (NSW) and Victorian Sub-section was in excess of 1700 members. More details are available in the booklet [1].

The main event of the 50th Anniversary celebration was a gala dinner organised by the Section's History Committee chaired by Ramutis Zakarevicius (Zak). The dinner was held at Darling Harbour close to Sydney's CBD at the Novatel hotel on the actual day 50 years previously that IEEE approved the formation of the Section. All Committee members were allocated tasks and whilst there were a number of last minute rushes, the event proceeded without a hitch.

Regrettably, one member of the History Committee had been travelling and was unable to be present on the evening.

The evening started with drinks and canapés at which it was a great chance to greet IEEE colleagues. A total of sixty seven people attended the dinner with eight apologies. There were several guests invited including members of the Section who

had been members of IEEE for fifty or more years. In attendance as invited guest were the two daughters of the founder the late Jim Vasseleu, and also the daughter of another late Chair, John Robinson, who were very pleased to be invited to the dinner and to represent their families. Also present as a guest was the President of the Australian Academy of Technical Sciences and Engineering, Prof. Hugh Bradlow. Prof. Andrew Parfitt (SMIEEE), the Vice-Chancellor of UTS, who was one of the seven past Section chairs present at the Dinner. Apologies were received from the President of the Academy of Science, Prof. Chennupati Jagadish (FIEEE), the Region 10 Director, Adjunct Prof. Janina Mazierska, as well as several Section members.

Before the meal commenced there were some formalities. This session was chaired by Graeme Gwilliam who welcomed all those present before inviting brief addresses from Colin Elston, the Section Chair, and the History Committee Chair, Zak.

After the formalities were concluded, the guests addressed more pressing matters, such as tucking into food courses as they were delivered to the tables as well as greeting and talking with other guests as shown in Fig. 3, which was one of many photographs taken on the evening. The reader can imagine that there was a lot of discussion during the dinner, as many people caught up with former colleagues and made new acquaintances. All agreed that the 50th Anniversary Dinner was an outstanding success.

References

- [1] T.S. Bird, C. Elston, K. Esselle, E. Fong, G. Gwilliam, & R. Zakarevicius, 'A perspective on the past while looking forward to the future - Brief history of the first 50 years of the IEEE Australian/NSW Section', IEEE NSW Section, 8 July 2022. [ISBN-978-0-646-86214-9]



Figure 3: Some of the attendees at the Anniversary dinner. Photo by Saulius Stepulis.

DANIEL JON MITCHELL, DPHIL, SENIOR HISTORIAN

Daniel Jon Mitchell joined the IEEE History Center as Senior Historian in July 2022. Previously he served as the Director of the Beckman Center for the History of Chemistry at the Science History Institute in Philadelphia.

Daniel was educated in the UK. He holds a BA in Physics and a DPhil in Modern History from the University of Oxford (2010), and an MA in Philosophy and History of Science from the University of Bristol. Two years teaching scientific and technological literacy at the University of Hong Kong sparked a global career in academia and the non-profit library and museum sector, during which time Daniel has written, presented, and taught widely on the history of modern physical science. He has held

research fellowships at RWTH Aachen University in Germany; at the Science Museum, London and University of Cambridge in the UK; and at Harvard University and the Science History Institute in the USA. Daniel recently acted as a consultant on a major grant project for the Center for History of Physics at the American Institute of Physics in College Park, MD.

The history of electricity and its associated technologies has interested Daniel ever since he embarked upon a series of summer engineering internships at National Grid while a physics student. His recent research has focused on measurement and quantification in the work of early electrical pioneers, such as Lord Kelvin and James Clerk Maxwell.

CENTER ACTIVITIES

ETHW UPDATE: BELLASCHI GLASS LANTERN SLIDES OF THE POWER INDUSTRY, NEW FIRST-HAND HISTORIES

The Engineering and Technology History Wiki (ETHW) is the History Center's main repository for historical content, with thousands of articles, first-hand accounts, oral histories, milestones, archival documents and lesson plans pertaining to the history of technology. The ETHW is one of the world's premier sites for the documentation, analysis, and explanation of the history of technology; the scientists, engineers and businesspeople who made these technologies happen; and on the history of the organizations to which these men and women belonged. Below is some of the new material you can view on the site.

Bellaschi Slide Collection

Peter L. Bellaschi was an IEEE Fellow, recipient of the 1937 Westinghouse Order of Merit, the 1982 IEEE William M. Habirshaw Award, and a long-time employee at the Westinghouse Transformer Division. He assembled a collection of several hundred glass lantern slides containing images related to many aspects of the power industry, which have been separated into the following categories: maps, drawings, test equipment, transformers, power towers & lines, lightning & discharge, nature, insulators, switch-



Peter Bellaschi

ing, capacitors, vehicles, people, and miscellaneous.

The IEEE History Center has scanned and posted the slides to the ETHW, where they can be viewed in a photo gallery. These can be viewed at: https://ethw.org/Archives:Peter_Bellaschi_Slide_Collection

New First-Hand Histories

The ETHW acts as a repository for first-person narratives and memoirs, which can be directly submitted to the site. Recently, a number of First-Hand Histories have been added to the site, including an account of Gunther Karger's role in national security, developing the world's first cellular communications network, "Experiences with the Membrain 7700" by Tanj Bennett, and several by A. Michael Noll, including: "Today's Metaverse: A Hazy Universe From the Past", "Disney and Early Computer Animation", "Two Years in Washington", and "Classical Music Prelude to Engineering".

To read these, or to submit your own, please visit: https://ethw.org/First-Hand:List_of_First_Hand_Histories

IEEE REACH ON THE GLOBAL STAGE

On 24, May 2022, IEEE REACH (reach.ieee.org) participated in the Open Education (OE) Global Conference held in Nantes, France. With assistance from Vincent Kaabunga, Past Chair IEEE Africa Council, and Kathleen Weeks, IEEE Senior Corporate Development Manager, a learning lab workshop, *Enhancing Secondary Teacher STEM Engagement and Increasing Access to Underserved Communities through International Collaboration*, with IEEE REACH was presented by Rovani Sigamoney (Engineering Programme Specialist, UNESCO Natural Sciences), Kelly McKenna (Sr. Program Manager, IEEE REACH), and Maryanne Karamagi (CEO, Silver Bolt). The OE Global Conference is the most internationally diverse conference devoted exclusively to open education, attracting researchers, practitioners, policy makers, educators, and students from nearly forty countries to discuss and explore how Open Education advances educational practices. This year's conference focused on the connection between open education and the five action areas of the UNESCO Open Educational Resources (OER) Recommendation.

Participants were introduced to the teacher educational resources found in IEEE REACH and they experienced a REACH hands-on activity. In addition, they learned how REACH combines historical technology narratives within inquiry designed lessons, which are then used in the classroom to link abstract concepts, such as how problems have been solved in the past, with real-life situations today. Insight was also shared about how IEEE is actively participating in STEM capacity building in secondary education through the international collaboration between IEEE REACH, UNESCO, and local non-profits such as Silver Bolt. This highlighted the work being done in Uganda, Africa, where the REACH program, in collaboration with the IEEE Africa Council and the IEEE Uganda Section, has provided real-world learning opportunities to secondary educators, focused on engaging girls in STEM and reaching underserved communities. As expressed by Maryanne Karamagi, "IEEE REACH inspires and engages students by showing the social relevance of engineering...it is not just History...it is inspirational for the workforce of tomorrow, particularly the youth and women in underserved communities..."

"IEEE REACH inspires and engages students by showing the social relevance of engineering...it is not just History...it is inspirational for the workforce of tomorrow, particularly the youth and women in underserved communities..."



Rovani Sigamoney and Kelly McKenna at the OE Global presentation with Maryanne Karamagi presenting virtually.

When highlighting the work done in Uganda, Rovani Sigamoney noted, "the REACH program offers real-world learning opportunities that provide inclusive applications and effective learning outcomes.... the program has taken innovation, science, engineering, and technology to rural areas with a focus on young women – replication and adaption in other countries is now our (UNESCO's) goal." She also shared that UNESCO would like to expand the program to other countries in Africa, through work with local UNESCO offices and UNESCO's National Commissions in Africa. The countries where UNESCO would like to see further implementation include: Zimbabwe, Kenya, Rwanda, Botswana, Namibia, Ghana, and Zambia. As stated by Ms. Sigamoney, "The program has the potential to improve capacity building, peer networking and an opportunity to potentially transform education."

In addition to assisting with the OE Global Conference presentation, Vincent Kaabunga was invited to participate in UNESCO's celebration of

World Engineering Day for Sustainable Development 2022. Mr. Kaabunga was one of six presenters during an international roundtable, *"Build Back Wiser - Engineering the Future,"* which was hosted by the UNESCO Natural Sciences Sector. The event was live-streamed on 4 March and can now be found on the World Engineering Day's website in the Ghana region replay. It may also be viewed on YouTube here: <https://www.youtube.com/watch?v=hXLavj6Wdv8>

On average 12,000 users visit IEEE REACH each year from one hundred and thirty countries, reaching an estimated 250,000 learners. The program is part of IEEE's public imperative; providing a new STEM education pathway in secondary education instilling a pipeline of students to preserve the profession. On a global scale, the program is also building public awareness and understanding of the engineering profession as a trusted educational resource, a part of the early stages of life-long learning. REACH is a donor funded program. Please visit the IEEE Foundation's donation page (<https://www.ieeefoundation.org/donate>) and click on the IEEE REACH Fund in the designation drop down menu to donate to the program.



Former site of the Amboy Avenue Station, looking north.



Newark to Trenton Fast Trolley former right of way. The Metuchen Switching Station visible at left.

GHOSTS OF TROLLEYS

History Center Research Coordinator Robert Colburn explores the layers of history beneath some high-voltage transmission lines in his neighborhood.

In the late 1800s and early 1900s, trolleys ran almost everywhere in the United States. Although many of the trolley routes in the United States came under financial pressure in the 1920s and 1930s and have long since disappeared, the careful observer can still trace their image in the landscape. High-voltage power lines are sometimes the unexpected ghostly presence of vanished trolleys and trains. Electric utilities, which were experiencing enormous growth as the United States electrified during the same decades that the trolley companies were going under financially, often bought up the trolley right of ways. These long stretches of land, stretches that led from town to town, especially in urban and suburban areas, were well-suited to the new purpose. As one use declined, another took its place. Because many trolley companies were subsidiaries of the utilities, this can be seen as a form of industrial evolution.

Let me introduce you to two of them: the New Brunswick-to-Metuchen Trolley and the Newark-to-Trenton Fast Trolley Line.

New Brunswick to Metuchen Trolley

The Public Service Railway was subsidiary of the Public Service Corporation of New Jersey. It owned a number of small railroads and trolley lines. Several of these ran through and out of New Brunswick, giving it its nickname of "hub city," which people still call it today. Originally horse-drawn in 1867, the trolleys were eventually electrified in 1895 and 1897 as the various trolley companies, merged, bought each other out, and fought long legal battles with each other. The 1897 line to Metuchen used the Amboy Avenue station (where the Route 1 bridge is today) as a layover point for passengers travelling from New Brunswick to Perth Amboy. From Perth Amboy, pas-

sengers could take a ferry across to Staten Island and onwards to Manhattan.

Newark-to-Trenton Fast Trolley Line

The Newark-to-Trenton Fast Trolley Line was originally incorporated 12 July 1894, but it took until 2 November 1903 for the first run to be made over the route, and regular passenger service did not commence until May 1904. A trip over the whole fifty-five mile route took 2hrs 45 minutes. By 1927, the growing competition from the automobile meant the line was losing money, and the Public Service Corporation placed its first double-circuit steel-tower 138,000 volt transmission line in service on the west side of the tracks. In 1929, PSE&G built the Metuchen switching station to serve residential and business distribution needs in the area. The timing was fortuitous; the Pennsylvania Railroad was electrifying its line between Washington, DC and New York City at approximately the same time. By 1934, the Metuchen switching station was providing power to the railroad. Initially, the power was converted from 60 Hertz alternating current to the 25 Hz alternating current used by the railroad via rotating mechanical frequency changers. In 2017, this was modernized to two solid-state converters.

On 16 January 1936, trolley service ended south of New Brunswick. Although service continued on the northern stretch of the line between New Brunswick and Newark, it was not for long. The last run was on 11 May 1937.

The day after the last run, workers began disassembling the tracks and bridges to convert the right-of-way entirely to electricity transmission. Two more 138kv circuits were built along the right of way.

Beginning in 2017, the middle 138kv twin circuits on lattice towers were replaced by a twin 230kV circuit on mono-

poles. The line is now also a right of way for fiber optic lines, and liquid and natural gas pipelines, as well as supporting cellular telephone installations. Stretches of the line south of New Brunswick are now rails-to-trails recreational walking and bike paths running under the transmission towers. The transmission line right-of-way between Metuchen and Trenton is eligible for listing in the National Register of Historic Places.

For technical details on the Newark-to-Trenton Fast Trolley Line and the high-voltage transmission line, see https://www.psegtransmission.com/sites/default/files/file/files/M-T-HAER_small.pdf

For more on the trolley lines of New Brunswick, <https://newbrunswicktoday.com/2015/01/04/the-trolleys-and-trains-that-made-new-brunswick-the-hub-city/>

TECH HISTORY ON THE WEB: STAFF FAVORITES

Did hippies invent networked computing? Cyrus Mody has written a cogent response to arguments that members of the so-called counter culture, the rebellious youth of the 1960s, were most responsible: <https://direct.mit.edu/books/oa-monograph/5352/The-SquaresUS-Physical-and-Engineering-Scientists>.

An “underexplored history of IEEE 802.11 standards,” Dr. Maria Rikitienskaia’s article, “‘The real Ethernet’: The Transnational History of Global Wi-Fi Connectivity” covers the rivalry between U.S. and European standard makers, the decision to focus on data transmission, the availability of wireless spectrum, and the peculiarities of network authentication: <https://journals.sagepub.com/doi/10.1177/14614448221103533>.

Glenn Reitmeier was a leading participant in the technical, commercial, and political development of high-definition television (HDTV) by the “Grand Alliance” of U.S. organizations. His website, www.glennreitmeier.tv/grand-alliance-hdtv-home, provides a rich treasury of documents and photos.

Stephen Herbert started his career as a film projectionist some fifty years ago. After working in a variety of related technical and historical occupations, he now writes about “early optical video media”—up to about 1940—on his blog, *The Optilogue*. Here he posts “accounts of my original research and experiences, and reflections and commentaries on popular and academic books and articles in this field.” Sign up for his periodic updates, which have extended into the dawn of television: <https://theoptilogue.wordpress.com/>.

Have you worked in, or with, the Irish information technology industry? The TechArchives project, <https://techarchives.irish/>, posts relevant memoirs, annotated timelines, documents, and photographs about Ireland’s digital evolution of computers and software and the people associated with them between 1956 and the early 2000s. Operated by Newsmail Ltd., which ceased operations in July, TechArchives offer grass roots opportunities to participants to help the history of their field.

John Atwood, audio engineer, has been updating his website’s appearance and adding more historic technical reports and documents from General Electric, RCA, and other 20th century companies: www.one-electron.com/Contact.html.

Employees of Memorex reunited for the defunct company’s fiftieth anniversary in 2011 and scanned hundreds of brochures, newsletters, photos, articles, press releases, and memorabilia from the company’s founding in 1961 to its bankruptcy in 2008: <http://mrxhist.org/index.html>.

Between 1999 and 2013, AT&T veteran Albert LaFrance developed *AT&T Long Lines Microwave Radio and Coaxial Cables*, <https://long-lines.net/>, and ColdWarComms to document AT&T’s contributions to telecommunications during the Cold War. There is a group list, <https://groups.io/g/coldwarcomms>

The online Crypto Museum, based in the Netherlands, continues to update its pages, particularly News related to cryptological history: www.cryptomuseum.com/index.htm. Its owners also have a physical collection and, in tandem with other organizations, they regularly organize exhibitions and other events.

GIVING & SUPPORT FOR IEEE HISTORY CENTER PROGRAMS

AUGUST EDITION OF IEEE FOUNDATION NEWSLETTER FEATURED IEEE HISTORY CENTER

The August edition of the IEEE Foundation newsletter titled: *Preserving the Legacy and Heritage of IEEE and its Members*, featured articles which highlight the IEEE History Center. These included articles about Expansion of IEEE Oral Histories, The

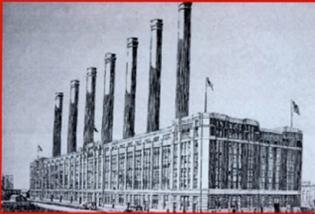
IEEE Elizabeth & Emerson Pugh Young Scholar in Residence and The IEEE Life Membawship in Electrical Engineering, and History Center donor Peter Wild. To read, please go to bit.ly/IEEEfnewsAug22

Your contributions to the **IEEE History Center Fund** preserve the heritage of the profession and its contributions to humanity.

We invite you to find out more about the Center and its programs at <https://www.ieee.org/about/history-center/index.html> and more about the Engineering & Technology History Wiki (www.ethw.org)

BOOKS FROM THE IEEE HISTORY CENTER PRESS

NEW YORK POWER



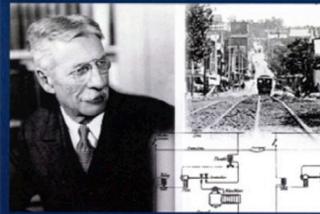
Joseph J. Cunningham

BELL LABS MEMOIRS: Voices of Innovation



EDITED BY A. MICHAEL NOLL
AND MICHAEL GESELOWITZ

THE BIRTH OF ELECTRIC TRACTION



The extraordinary life of inventor Frank Julian Sprague

Frank Rowsome, Jr.

SPRAGUE ELECTRIC



An Electronic Giant's Rise, Fall, and Life after Death

John L. Sprague

NEW YORK POWER by Joseph J. Cunningham tells the story of the electrification of one of the densest electrical load areas in the world. Electrification began during the 1880s, but many innovations were required to supply urban service at a cost that would make possible large-scale consumption.

https://www.amazon.com/New-York-Power-Joseph-Cunningham/dp/1484826515/ref=tmm_pap_swatch_0?encoding=UTF8&qid=&sr=

BELL LABS MEMOIRS: VOICES OF INNOVATION:

The innovative spirit and creative energy of Bell Labs during the directorship of William Baker are described by twelve people who worked there. Through their eyes and words, the culture of Bell Labs comes alive.

https://www.amazon.com/dp/B006L7JRLY/ref=dp_kinw_strp_1

THE BIRTH OF ELECTRIC TRACTION: THE EXTRAORDINARY LIFE OF INVENTOR FRANK J. SPRAGUE:

Sprague made enormous contributions in the areas of electric traction, control and safety, especially automatic signaling and brake control for railroads. He was active in the planning and construction of New York City's subway system, and in the electrification of Grand Central Terminal.

https://www.amazon.com/Birth-Electric-Traction-extraordinary-inventor/dp/1490955348/ref=sr_1_1?crid=20XP2PN006USY&keywords=birth+of+electric+traction+sprague&qid=1641497922&s=books&prefix=birth+of+electric+traction+sprague%2Cstripbooks%2C119&sr=1-1

SPRAGUE ELECTRIC: Sprague Electric Company's rise from a high-tech kitchen-table startup is representative of much of the U.S. electronics industry. Begun in 1926, it became a thriving manufacturer of components. More than 50,000 Sprague components rode aboard every *Apollo* mission, and more than 25,000 aboard every Space Shuttle. *Sprague Electric* provides a valuable business and technological history, a story of corporate success...and a cautionary tale of what to avoid.

https://www.amazon.com/Sprague-ElectricElectronics-Giants-afterdp/150338781Xref=sr_1_1?crid=HRWR6CMKM0D&keywords=sprague+electric&qid=1641498091&s=books&prefix=sprague+electric%2Cstripbooks%2C147&sr=1-1

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: the Pugh Visiting Scholar for an advanced undergraduate, graduate student, or recent Ph.D., and a dissertation fellowship for an advanced graduate student or recent Ph.D. The Pugh Scholarship requires residence at the IEEE History Center, in Piscataway, 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 \$25,000 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 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 the July of the year that it is awarded. Fellowship checks are normally mailed to the Fellow quarterly in July, October, January, and April. For Fellows in the southern hemisphere who follow the southern hemisphere academic year, arrangements can be made to mail the checks in December (two quarters worth), March, and June.

Candidates with undergraduate degrees in engineering, the sciences, or the humanities are eligible for the fellowship. For pre-doctoral applicants, however, the award is conditional upon acceptance of the candidate into an appropriate graduate program in history at a school of recognized standing. In addition, pre-doctoral recipients may not hold or subsequently receive other fellowships, but they may earn up to \$5,000 for work that is directly related to their graduate studies. Pre-doctoral fellows must pursue full-time graduate work and evidence of satisfactory academic performance is required. These restrictions do not apply to post-doctoral applicants.

The Fellow is selected on the basis of the candidate's potential for pursuing research in, and contributing to, electrical history. Application forms are available on-line at http://www.ieee.org/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, 445 Hoes Lane, Piscataway NJ 08854. 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.

Elizabeth & Emerson Pugh Young Scholar in Residence

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 the Elizabeth & Emerson Pugh Young Scholar in Residence at the Center's offices at the IEEE Operations Center, Piscataway, New Jersey, USA.

The residency 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 Young Scholar 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. Pugh scholars are also encouraged to consult with the Center's staff and its associates, and guided to research resources in the area. The residency 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 is US\$5,000.

There is no formal application form. To apply, please mail curriculum vitae showing your studies in electrical history, 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 is an AA/EO employer. 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 Technology. 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, 445 Hoes Lane, Piscataway, NJ 08854, +1 732 562 5450, ieee-history@ieee.org, http://www.ieee.org/about/history_center/index.html.

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