IEEE History Center

ISSUE 124, March 2024

SPECIAL ISSUE: UNPACKING THE IEEE GLOBAL MUSEUM

Design concept for "Unseen Signals: Edwin H. Armstrong's Radio Revolution," the flagship travelling exhibit of the IEEE Global Museum

Signals from the Director 2

History Committee Activities 3

Shadows of the Past

Center Activities 4

IEEE Global Museum: Bringing the Innovations of the Past to View

The Secret Life of Artifacts

ETHW Update

IEEE Oral History Update

IEEE REACH Cross-Cutting Education Discliplines

Tech History on the Web: Staff Favorites 10

Interesting Reads 10

Giving and Support for IEEE History Center Programs 12

Maxwell's Ether: From Wave Optics to the Electromagnetic Theory of Light

IEEE Life Member Positions IEEE History Center at the Top of His Charitable List

Russell Finn Wins IEEE Prize for Best Article on Electrotechnology History

No content in this issue was generated by AI.

IEEE History Center

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.

IEEE History Center
445 Hoes Lane
Piscataway, NJ 08854

Telephone +1 732 562 5450
E-mail: **ieee-history@ieee.org**
www.ieee.org/about/history-center/index.html

SIGNALS FROM THE DIRECTOR

Michael N. Geselowitz
Senior Director, IEEE History Center

It is my pleasure to welcome you to another issue of the *IEEE History Center Newsletter*, and another year of exciting IEEE historical activities. IEEE History Center staff look forward to working with the 2024 IEEE History Committee, other IEEE volunteers and members, and academic, public, and advocational historians and museum professionals around the world in efforts to preserve and disseminate the history of IEEE, its members, their professions, and the related technical fields of interest.

This issue highlights our newest program, the IEEE Global Museum (see page 4). I think you will agree after reading the several articles around this activity that it is not just an evolution in our dissemination to the general public, but a revolution. In the meanwhile, our second newest program, IEEE REACH, continues its dissemination to the pre-university audience (see page 9), while our publication, lecture, and conference activities target engineering and historical professionals.

WAYS YOU CAN HELP HISTORY

As you read this newsletter, you will see the many success stories of the IEEE History Center and the ways it nurtures the heritage of the profession. As successful as the Center is, it relies on the support and contributions—financial, intellectual, and time and effort—of many people. We ask you to help further our work by:

Proposing an IEEE Milestone—Milestones recognize significant achievements in technology **ieeemilestones.org**

Contributing a First-Hand History—Written and oral histories help us chronicle important innovators and innovations **http://ethw.org/create**

Authoring an article for the ETHW—The Engineering and Technology History Wiki (ETHW) is an authoritative collection of historical information about technology's contributions to society **ethw.org/create**

Supporting the History Center's mission with a donation.

However you can help, it is always deeply appreciated.

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://ieeemilestones.ethw.org/Milestone_Guidelines_and_How_to_Propose_a_Milestone**

Milestone proposals in process: **http://ieeemilestones.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

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 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: 500–1210 words. Submit to **ieee-history@ieee.org**. Articles and letters to the editor may be edited for style or length.

In that latter category of working with professional historians, I should also mention the recognition activities carried out by the IEEE History Committee: The IEEE Finn Prize in partnership with the Society for the History of Technology; the Middleton Book Award; and the IEEE Life Member History Fellowship. Professor Mara Mills, an eminent historian of the of the interaction of disability and technology at New York University, is a recipient of both the IEEE Finn Prize and the Life Member History Fellowship, both of which are funded by the IEEE Life Members Fund of the IEEE Foundation, overseen by the IEEE Life Member Committee. Recently the *IEEE Life Member Newsletter* profiled Professor Mills, and she discussed the importance of IEEE's historical activities to her own career and the history of technology overall: **https://life.ieee.org/disability-technology-why-history-matters/**.

Meanwhile, our preservation activities, such as oral history, archives, and the Engineering & Technology History Wiki (see page 8), also continue to go strong.

Therefore, I want to thank you once again for your past support, and remind you that these activities are supported in large part through the generous gifts of our donors (see IEEE Foundation article on page 12). I look forward to continuing to work with you and to earn your support.

HISTORY COMMITTEE ACTIVITIES

SHADOWS OF THE PAST

By David G Michelson
Chair, IEEE History Committee

Plutarch, in the opening sentences of his *Life of Demosthenes*, reminds us that many of the challenges that historians face today are longstanding:

> *Whosoever shall design to write a history, consisting of materials which must be gathered from observation, and the reading of authors not easy to be had nor writ in his own native language, but many of them foreign and dispersed in other hands: for him it is in the first place and above all things most necessary to reside in some city of good note and fame, addicted to the liberal arts, and populous, where he may have plenty of all sorts of books, and, upon inquiry, may hear and inform himself of such particulars as, having escaped the pens of writers, are yet faithfully preserved in the memories of men; lest otherwise he publish a work deficient in many things, and those such as are necessary to its perfection.*[1]

Historical study is dependent on evidence that is inherently fragile and often irreplaceable. A number of related practices, including historic preservation, museum curatorship, archival science, records management, and oral history, have evolved to preserve such evidence for both academic study and the public good. As events recede ever further into the past, the effort required to locate and preserve these shadows of the past increases dramatically. Accordingly, efforts to preserve the past should ideally begin in the present.

Primary or original source materials are generated as the historical event unfolds or afterwards by those who experienced the event. They may take the form of plans and drawings, orders and schedules, diaries and first-hand accounts, recordings (including photographs, video recordings, and audio recordings), internal reports (including technical reports, conference presentations and journal papers), external reports (including news accounts), artifacts (including devices and engineering prototypes), and landmarks (including structures and buildings). Secondary source materials are interpretations of primary source materials produced by those who didn't directly experience or witness the event.

The amount of primary source material that is generated depends greatly on the nature of the event and the organization involved. In many cases, the historical significance of an event may not be recognized until long after the event has taken place. Once primary source material is generated, it must be preserved and made accessible for future use. This doesn't happen automatically, and a great deal of historical evidence is lost as individuals and organizations discard records and evidence no longer required for their original purpose.

While historical evidence is necessary for historical study, it is not in itself sufficient. Both historical context and historical imagination are required to usefully reconstruct or interpret historical events. Much of our current thinking regarding such matters comes from the work of R. G. Collingwood, a British philosopher and historian who was active in the first half of the twentieth century [2]. Collingwood was especially concerned with the similarities and differences between the work of the natural scientist and the work of the historian, and how historians could and should use historical evidence to interpret or reconstruct the past.

Collingwood believed that history, as an organized body of knowledge, is a science. However, he argued that history differs from natural science in that natural scientists can generally observe the target of their study directly and repeatedly, while historians are generally limited to studying whatever evidence remains after the event took place. If there are gaps in the evidence, the historian generally has no alternative but to either find additional evidence or use their best judgment to fill in or reconstruct the missing details.

Collingwood also argued that historical events have

Continued on Page 4

both an 'external' or observable component and 'internal' or experiential component. The observable component is concerned with what transpired, is often resolved based on multiple observations from multiple perspectives, and is only fully knowable after the event. By contrast, the experiential component is concerned with how the event was perceived or experienced by individual participants. Collingwood's belief that both perspectives are essential for reconstructing and interpreting historical events provides vital clues regarding the nature, and especially the diversity, of the historical evidence that we should seek to preserve.

There is more to the history of technology than simply remembering or reminiscing about past events. The goal of the IEEE History Committee is to contribute to efforts to understand and share our past with both the profession and the general public in a manner that is accurate and fair-minded using methods that are both efficient and consistent. Our ultimate goal is to explain why things are the way are today so that this knowledge and understanding may inform better decisions about tomorrow. We are looking forward to an exciting year ahead.

References

[1] Quoted in J. J. Fahie, *A History of Electric Telegraphy, to the Year 1837,* London, UK: E. & F.N. Spon, 1884, p. vii.

[2] R. G. Collingwood, *The Idea of History.* Oxford, UK: Oxford University Press, 1946, revised ed., 1993, 576 pp.

CENTER ACTIVITIES

IEEE GLOBAL MUSEUM: BRINGING THE INNOVATIONS OF THE PAST TO VIEW

By Dr. Daniel Mitchell
Senior Historian

The vision for the Global Museum is to promote an understanding of electrotechnology and its impact upon society by bringing museum-quality exhibits to IEEE members and the public, from a single treasured artifact to a full collection. The "global" in Global Museum is intended in several senses. It reflects the reach of IEEE as a global community of technical professionals, the worldwide historical impact of electrotechnology, and our long-term ambition to travel exhibits to technology museums and IEEE conferences and events around the world. The range of activities conducted under the umbrella of the program reflects the diverse aims of the IEEE History Center: to serve IEEE members, promote IEEE and the profession of electrical and electronic engineering, and engage the public in the history of electrotechnology.

When I came on board at IEEE in July 2022, I was excited about the opportunity to build a new exhibits program under the rubric of the IEEE Global Museum. I also felt trepidation. How could the History Center fulfil a vision that seemed like only a storied, state-funded museum like the Smithsonian or the Deutsches Museum could accomplish? But as I settled into the role and learned more about the organization, I discovered two things that you already know. First, IEEE thrives upon the strength of its volunteer and member network, which has opened doors to local and national museums, private collectors, universities, corporations, and other organizations. And second, year in year out, more than one thousand staff members deliver an international portfolio of activities germane to the Global Museum, particularly in conferences and publications. I realized that we could succeed by building networks and partnerships, both within and outside IEEE, and by drawing upon our existing strengths. The articles in this special issue on the IEEE Global Museum demonstrate the fruits of this strategy.

We'd value your help as we continue to grow the program. If you feel you can contribute in the following or in other ways, I'd be pleased to hear from directly at **daniel.mitchell@ieee.org**

Donate artifacts: Although our storage space is limited, we are always looking to add significant or unique pieces to our artifact collection. Sometimes we may put out a call for specific artifacts (see "Chip Hunting").

Give to the IEEE Global Museum fund: The IEEE Foundation can now accept donations specifically intended for the IEEE Global Museum. You can select this fund on the IEEE History Center donation page.

Offer your practical expertise: We are seeking volunteers to help repair or restore antique electronic and other electrical equipment, particularly in Pennsylvania, New Jersey, or the New York metropolitan area.

Share contacts: We are always looking to develop connections to institutions or individuals who are committed to preserving and exhibiting artifacts in the history of electrotechnology.

It remains for me to thank an anonymous donor for the major gift that launched our flagship project, the travelling exhibit Unseen Signals: Edwin H. Armstrong's Radio Revolution (see "Edwin H. Armstrong, Rewired"); John Impagliazzo, whose service and leadership in various roles on the IEEE History Committee led to the creation of the IEEE Global Museum; and the IEEE Foundation and IEEE Life Members, for their steadfast support.

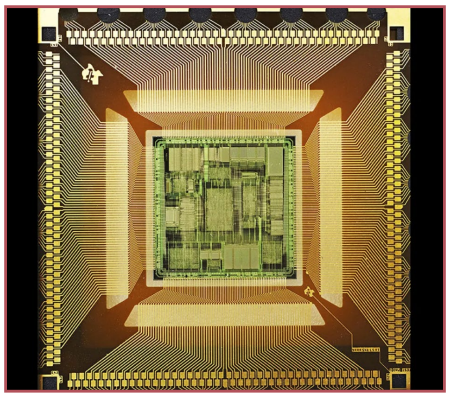
CHIP HUNTING WITH *IEEE SPECTRUM*

> *"The 'fantastically rare' ARM1, for instance, according to IEEE Spectrum Senior Editor Stephen Cass, 'may only exist in the wild in equally rare BBC Micro evaluation modules.'"*

The IEEE Global Museum is collaborating with *IEEE Spectrum* magazine to create a highly-mobile, engaging, interactive travelling exhibit based on its digital Chip Hall of Fame. Our aim is to explain why integrated circuits or microchips were designed and engineered, and to open up the rich world of rivalries, gambits, and grand designs hidden behind the black plastic and metal contacts. Visitors will encounter the varied roles performed by integrated circuits, such as signal processing, audio engineering, telecoms, and more. We want to connect opaque names like Z80, 6502, and ARM1 to products you will remember or recognize from your own lives, such as a favorite home computer or video game console, from the 1980s up to the GPS-enabled smartphones we all carry today.

We have been hunting down the physical chips for inclusion in the exhibit. Can you help us complete our collection? Chips we have not yet acquired are listed in the table. We are interested in both the chips and any products they can be found inside. Some of these chips are nowadays quite rare and may only be found on circuit boards. The "fantastically rare" ARM1, for instance, according to *IEEE Spectrum* Senior Editor Stephen Cass, "may only exist in the wild in equally rare BBC Micro evaluation modules." Contact **Daniel.Mitchell@ieee.org** to offer advice.

Chip	Type
Micronas Semiconductor MAS3507	MP3 Decoder
Western Digital WD1402A	Universal Asynchronous Receiver and Transmitter (UART)
Nvidia NV20	Graphics processor
Acorn Computers ARM1	CPU
IBM Deep Blue 2	Custom chess chip
Kodak KAF-1300	Image sensor
Mostek MK4096	Dynamic Random Access Memory (DRAM)
Intel 4004	CPU
Photobit PB-100	Image sensor
Sun Microsystems Sparc M7	CPU
ST Microelectronics STA2056	GPS receiver



Sun Microsystems SPARC Processor, an IEEE Milestone

EDWIN H. ARMSTRONG, REWIRED

Our exhibit on Edwin Howard Armstrong, the electrical engineer and wireless pioneer who received the Medal of Honor from the IRE in 1917, continues to progress towards its public launch. We are excited to announce that we have partnered with Upland Exhibits, an exhibit development firm based in Kansas, to create a purpose-built travelling version of the exhibit named "Unseen Signals: Edwin H. Armstrong's Radio Revolution."

The pilot Armstrong exhibit made its debut in February 2023 at the IEEE Board Series held at the Sheraton Hotel, New York City. Since that time we have been exploring ways to scale up the exhibit to fit the typical sizes of museums' temporary galleries, and to develop a means of packing and shipping it nationwide. The partnership with Upland will enable us to create a purpose-built solution to these challenges.

"Unseen Signals" aims to make Armstrong's life and achievements known among the general public and reveal his vital role in creating our wireless age. The design concept (shown on the front cover) pairs IEEE History Center research and storytelling with curated artifacts, evocative graphic design and interactive elements that explicate Armstrong's technical breakthroughs to the layperson.

Without artifacts there would be no exhibit. We are extremely grateful to the Pavek Museum in Minnesota, and the New Jersey-based collectors and restorers Mike Molnar and Al Klase, for loaning us a number of antique radios; Marsha Simkin, for donating the Jerry and Marsha Simkin collection of radio memorabilia and cultural ephemera; Robert Brecht and Anthony Fiore, for donating a 1912 Audion from Armstrong's Columbia University laboratory; and Dennis L. Shapiro, for funding the purchase of several key items, including a World War I radio headgear like the type worn by [then] Captain Armstrong.

Our pilot Armstrong exhibit will remain on display at IEEE Headquarters in New York until July 2024, until the artifacts need to be shipped to our first venue, the San Antonio Museum of Science and Technology (SAMSAT) in Texas. "Unseen Signals" will then travel to the Pavek Museum at the beginning of 2025, and then to other renowned museums across the United States through at least 2027.

MARKETING ELECTRICAL HISTORY AT THE CONSUMER ELECTRONICS SHOW

"Our idea was to illustrate the compactness and versatility of smartphones in historical terms, by surrounding an original iPhone with devices that smartphones have largely rendered obsolete."

Spin the wheel to land on a pivotal moment in electrical history

History Center staff worked in partnership with the IEEE Corporate Communications and Brand Marketing team to create historical exhibits for the IEEE Technology Innovation Exploration pavilion at the 2024 Consumer Electronics Show in Las Vegas, held in January 2024. CNN called CES "the largest tech conference of the year" with an official attendance of 135,000.

As a means of showcasing IEEE's institutional role in developing international standards and building technical communities, the Technology Innovation Exploration pavilion took visitors on a tour of the past, present, and future of technological development. History Center staff prepared four of the exhibits within the pavilion. A giant rotating slide-viewer wheel depicted six iconic moments in electrical history, from Edison's invention of the incandescent lightbulb to the development of SHAKEY, the earliest mobile intelligent robot. We were given an analogous brief for the adjacent artifact display, namely to select six groundbreaking electrical technologies—no easy feat when there are now 246 IEEE Milestones.

A wall-mounted exhibit drew upon our recently-acquired Doug Dixon collection of handheld consumer electronics. Our idea was to illustrate the compactness and versatility of smartphones in historical terms, by surrounding an original iPhone with devices that smartphones have largely rendered obsolete. Visitors were enthralled to browse the original iPhone iOS on its tiny 3.5-inch screen. Highlights included the first Camcorder, an original Sony Betamax from 1984, and one of the earliest digital cameras from 1995, developed, remarkably, by Apple in collaboration with Kodak and Chinon. Think how far we've come in three decades: the Quicktake 150 stored sixteen photos at a VGA resolution of 640x480 pixels.

Plans are underway to further develop and travel the fourth exhibit, a touchscreen interactive tech timeline game. As we go to press, IEEE leadership will get the chance to take the "Technology Timeline Challenge" at the IEEE Board Series in February, and hence test their knowledge about when key innovations took place. The wall-mounted smartphone exhibit will likewise go on show across the Atlantic at the Mobile World Congress (MWC) in Barcelona at the end of February, which bills itself as the world's largest and most influential connectivity event.

The artifact table featured a working Motorola Dynatac 8000 series "brick" cellphone (1992) and Pilot TV-37 (1948).

Visitors were enthralled to browse the original iPhone iOS on its tiny 3.5-inch screen.

IN CHARGE OF DIELECTRIC AND INSULATING MEDIA

The exhibit's signature piece—a large fabric wall—uncovered the rise and fall of the GE and Westinghouse high voltage power engineering laboratories.

The IEEE Dielectrics and Electrical Insulation Society (DEIS) celebrated its 100th anniversary in 2023 with an exhibit curated by our Senior Historian, Dr. Daniel Mitchell, called "In Charge: Technology Flows through Dielectric and Insulating Media."

The DEIS lies at the intersection of many IEEE fields of interest. Its founding in the 1920s was rooted in high-voltage power engineering and radio and telephone communications, and can be traced to a Committee of the US National Research Council. The advent of synthetic materials marked a major development in dielectric technology. During the postwar period the range of technologies based on these materials expanded rapidly. The commercialization of the transistor and development of solid-state electronics in the 1950s and 1960s brought semiconductor materials and electrical behavior at microscopic scales under the remit of the DEIS.

"In Charge" was unveiled at the DEI Society's annual Conference on Electrical Insulation and Dielectric Phenomena (CEIDP), held in East Rutherford, NJ, in October 2023, and was subsequently recreated at the IEEE Board Series in Washington DC in November. It illustrated the historical phases and shifts of DEIS fields through interpretive panels on power and communication cables, and the electret condenser microphone invented by Gerhard Sessler and James West in 1962. Thanks to generous artifact loans from AT&T and Nokia Bell Labs, the exhibit incorporated an original section of the first Transatlantic Telephone Cable, TAT-1, from 1956, and a prototype Western Electric EL2 electret "transmitter" or microphone, which entered production in 1978.

Thanks to generous artifact loans from AT&T and Nokia Bell Labs, the exhibit incorporated an original section of the first Transatlantic Telephone Cable, TAT-1, from 1956

The exhibit's signature piece—a large fabric wall—uncovered the rise and fall of the GE and Westinghouse high voltage power engineering laboratories. It charted their inception during the 1920s, when major cities became electrified, through their closure during the 1980s, in part owing to the demise of the U.S. transformer and power circuit breaker markets. By this time, these laboratories had nonetheless made possible safe, cost-effective long-distance power transmission at extra high voltages up to 765kV.

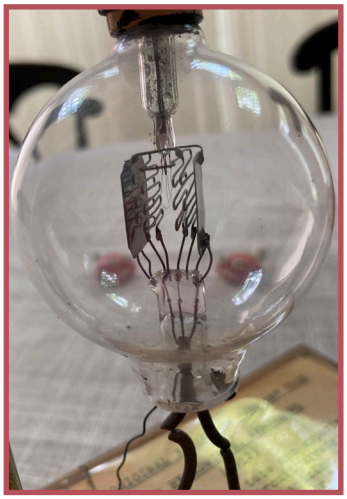
IEEE Global MUSEUM™
Presented by IEEE History Center

THE SECRET LIFE OF ARTIFACTS

By Alexander B. Magoun, Ph.D.
Outreach Historian

Seen in an exhibit or a museum, artifacts are usually staged behind glass, Plexiglass, or a heavily cordoned perimeter to protect them from idle hands, humidity, and contaminants. This makes sense in the institutional commitment to preserve its artifacts for eternity. The accompanying labels contain relevant facts: date of production, composition, and dimensions, along with the briefest of explanations. Visitors often do not learn the complex stories of how the objects got to where they are.

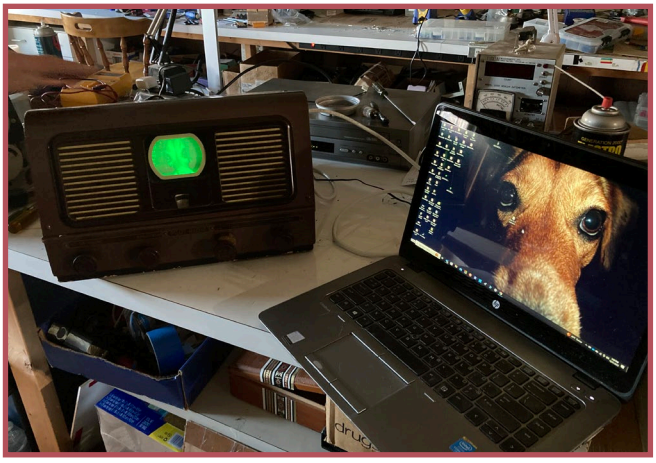
Yet each artifact has stories of provenance and preservation predating its exhibition. Consider the Audion vacuum tube donated last year by Robert Brecht to the IEEE History Center. A nephew of Howard Armstrong, Brecht met a fellow resident of their small community, Anthony Fiore. Fiore's father Vito had been a lab technician supervisor at Columbia University. After Armstrong's death in 1954, the elder Fiore salvaged the tube and built it a custom frame to protect the delicate glass envelope and filaments within; the younger Fiore passed it back to the family. The spherical Audion was a product of Henry McCandless's miniature lamp factory on 67-69 Park Place in Manhattan, New York City. One of the eight hundred and fifty-eight Audions that McCandless sold to various customers in 1912, it contains two tungsten filaments, two grids, and two plates—a design to extend operating life by Audion inventor Lee DeForest, and Armstrong's bitter rival. This would have cost a bit more than the US$4 "single wing" tube of the time; at today's equivalent of US$129 it would have been well under the price of, for example, current graphics cards for videogames.



The two-filament, two-grids, and two-plate Audion tube owned by Howard Armstrong

Seven years ago, between trips to war zones in Africa, TV collector Adam Sayles, M.D., donated a restored Pilot TV-37 *Candid* television receiver to the IEEE History Center. Pilot Radio's chief engineer Werner Auerbacher designed the set in the late 1940s and recounted to the History Center's Rik Nebeker what inspired him (**https://ethw.org/Oral-History:Werner_F._Auerbacher**). He estimated that Pilot made more than 50,000 TV-37s, which are popular among collectors because they are conveniently small and distinctively styled. The Candid is notable because Pilot priced it in 1948-49 at US$99, less than half the cost of the standard 10-inch/26cm TV set in the United States, or US$1,260 today. The drawbacks were the 7.5cm cathode-ray tube, the continuous tuning of channels, and the lack of a power transformer, making the chassis electrically hot.

When IEEE's Strategic Marketing group requested a historical exhibit at Consumer Electronics Show 2024, Senior Historian Daniel Mitchell seized the opportunity to use the Center's *Candid* to simulate the television experience of seventy five years ago for attendees. A digital-to-analog converter and video balun streamed clips of *Casablanca* to the TV, but not cleanly. To the historians' relief, electrical engineer, businessman, and collector Mike Molnar and his assistant Lila were available to improve on the restoration that Dr. Sayles commissioned. The exhibit enjoyed much attention from some of CES's 135,000 visitors. To gain some idea of what was involved on Mike's well-equipped bench, search <Pilot TV-37 restoration>; lots of collectors have shared their experiences and expertise in working with discrete analog electronic components.



Mike Molnar's workbench with Lila as the test pattern for the Pilot TV37 as it was prepared for the CES exhibit.

ETHW UPDATE

ASHRAE Joins ETHW Consortium

The Engineering and Technology History Wiki (ETHW) is a website powered by MediaWiki 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 business people who made these technologies happen; and on the history of the organizations to which these men and women belonged.

It fosters the creation of narratives that not only document the history of engineering practices but also explain when, how, and why these technologies developed as they did. It uses a wiki-based web platform to foster a collaborative online environment that taps into the collective memories, experiences, and knowledge of engineering's worldwide membership – the men and women who provide the imagination,

creativity, and know-how to sustain engineering progress and technological innovation. In time, this site will serve as a central historical repository of all the achievements, ideas, and first-hand knowledge of engineering association members, societies, councils, and technical communities. The ETHW will also provide a central location for all materials related to engineering's organizational history.

The ETHW was developed by a partnership between the United Engineering Foundation and several engineering societies. Recently, ASHRAE, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, has formally joined the ETHW consortium with the AIAA, AIChE, AIME, ASCE, ASME, IEEE, SPE, and SWE. Founded in 1895, with more than 50,000 members worldwide, ASHRAE has a rich history related to technologies that often intersect with IEEE's fields of interest, and the IEEE History Center is looking forward to productive collaborations with ASHRAE's history operations in 2024.

To visit the ETHW, go to: **https://ethw.org**

IEEE ORAL HISTORY PROGRAM UPDATE

By Mary Ann Hellrigel, Ph.D.
Institutional Historian, Archivist, and Oral History Program Manager

The IEEE History Center commemorates IEEE's 140th anniversary by collecting the oral histories of IEEE Past Presidents.

In 2009, as part of the celebration of the 125th Anniversary of IEEE, the IEEE History Center undertook a project to record oral histories with as many living past presidents as possible. This project has continued. Currently, thirty-one past presidents have oral histories posted on Engineering and Technology History Wiki. Recently, the transcript for José M. F. Moura (2019) has been posted and the oral histories of five more are being processed, including those of Richard Gowen, Leah Jamieson, Roberto de Marca, and Howard Michel.

Once again, the History Center is celebrating an IEEE anniversary, this time, the 140th with renewed efforts to expand this collection. In January, Karen Bartleson recorded her oral history with Mary Ann Hellrigel who has already scheduled recording sessions with IEEE past presidents Gordon Day and Barry Shoop, and Susan (Kathy) Land has also committed. Mary Ann has emailed other IEEE past presidents and hopes to collect the oral histories of all surviving IEEE past presidents. Please contact Mary Ann: **m.c.hellrigel@ieee.org**

On the oral history front, the History Center's Life Fellows Oral History Project and its peer-to-peer element resulted in Hellrigel training 110 IEEE members and a few staff members to be interviewers. During the past few years, a devoted group of volunteers, including 2024 IEEE President Tom Coughlin, Maxine Cohen, Eugene (Gene) Freeman, and T. Scott Atkinson, have served as interviewers. THANK YOU. It was an honor and pleasure working with them.

In June 2023, Hellrigel traveled to Rhodes, Greece to attend ICASSP 2023 (2023 International Conference on Acoustics, Speech, and Signal Processing) to record oral histories to help the IEEE Signal Processing Society mark its 75th anniversary. She recorded the oral histories of Alfred Hero, Mostafa Kaveh, Alan Oppenheim, Alex Acero, and Ronald Schafer and they are also being processed.

Finally, Hellrigel will offer an Oral History Workshop on 14 April 2024 at the Life Members' Conference to be held in Austin, Texas, 14 – 16 April 2024. **https://life.ieee.org/ieee-life-members-conference-dates-and-location/**

The IEEE Oral History Program is vibrant and diligently strives to expand the collection (more than 900) and make the lightly edited transcripts (nearly 800) available to the IEEE members and the public via **ETHW.org**.

IEEE REACH CROSS-CUTTING EDUCATION DISCIPLINES

In November 2023, the IEEE REACH program was approved, and honored, to participate in the United States' Council of State Social Studies Specialists' (CS4) annual conference as an organizational member. The IEEE REACH organizational membership for 2023 was approved by the CS4 Board. CS4 is an organization whose members are predominately Social Studies supervisors at the state Department of Education level from all states within the United States. As part of CS4's annual conference, Kelly McKenna, Senior REACH Program manager was thrilled to have an opportunity to share the IEEE REACH program with the membership. REACH is the History Center's program of free, online, open educational resources on the history of technology for the pre-university educator and is applicable for both the Social Studies and STEM classroom. REACH provides a cross-cutting platform for understanding the social relevance of technology and engineering. Social Studies provides an excellent opportunity to introduce students to technology through a different lens. The program's focus on history is a catalyst for engaging all students in technology and engineering, while providing a new pathway to STEM careers, especially for girls. Participation at this event gave the IEEE REACH Senior Program Manager an opportunity to open a dialogue about ways to use the REACH resources within members' respective states. Plans are already underway with two state Social Studies leaders to implement REACH workshops within their respective states in 2024.

The CS4 annual conference is held just prior to the U.S. National Council for the Social Studies' annual conference where IEEE REACH was also exhibited. A tremendous amount of enthusiasm about the IEEE REACH program was expressed

Continued on Page 10

byby more than one hundred and fifty educators who engaged directly with the IEEE REACH resources at the conference.

The IEEE REACH program is also scheduled to present a workshop at the International Technology and Engineering Educators Association's (ITEEA) annual conference being held in Memphis in March 2024. ITEEA is the professional organization for technology, innovation, design, and engineering educators. ITEEA's mission is to advance technological and engineering capabilities for all. The IEEE REACH team is excited to participate in this conference for the third time and always welcomes the opportunity to connect directly with educators.

TECH HISTORY ON THE WEB: STAFF FAVORITES

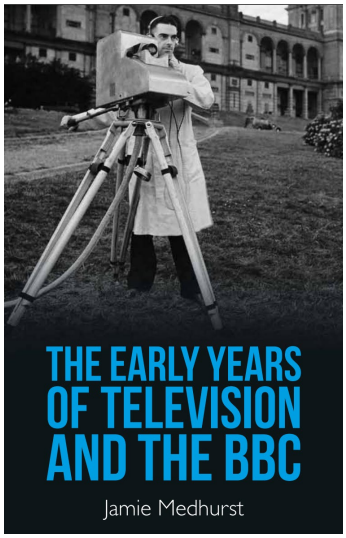
Horacio A. Nigro Geolkiewsky CX3BZ has been adding steadily to his "Notes on Radio," *La Galena del Sur*, with brief histories and fascinating images for historians and wireless enthusiasts of radio, television, and wireless communications in Uruguay, **https://lagalenadelsur.com/**.

Jerry Berg has been Dxing for more than fifty years and documenting the history of his avocation for nearly as long. Besides his short, informative, and carefully documented books, together with John Herkheimer he maintains a website of interest to all interested in the evolution of long-distance wireless communications: **www.ontheshortwaves.com/index.html**.

A regular subject of debate among historians is the source of the contributors to a technology, profession, institution, or subject of study in any given location. Was it locally created or was it transferred from elsewhere and reconstituted? Do the contributors upset the status quo, or maintain it? *ENGIND* is a scholarly and stimulating blog, funded by France's Agence Nationale de la Recherche, on this subject as it relates to engineers and India over the last 175 years: **https://engind.hypotheses.org/2177#more-2177**.

The Encyclopedia of the History of Science, **https://lps.library.cmu.edu/ETHOS/**, modeled on *The Stanford Encyclopedia of Philosophy*, provides peer-reviewed articles on selected topics including *Laboratory, Manhattan Project,* and *Materials Science.*

INTERESTING READS



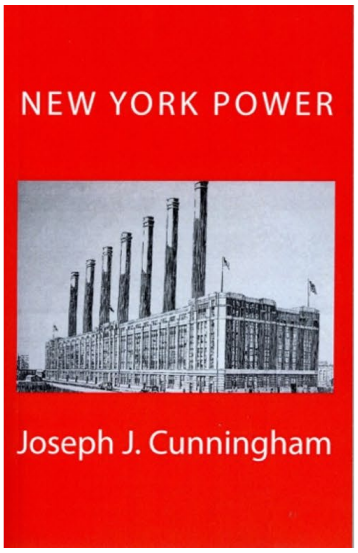
MEDHURST, JAMIE
The Early Years of Television and the BBC, Edinburgh University Press, 2022

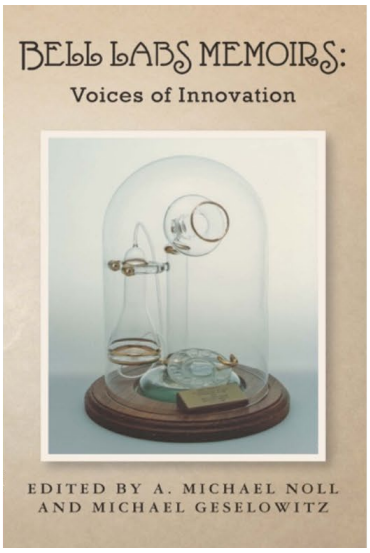
The centenary of the British Broadcasting Company's inaugural wireless broadcast on station 2LO in 1922 resulted, unsurprisingly, in a flood of retrospective research, resources, narratives, and analyses of the evolution of the BBC (now a corporation). Among them is Professor Medhurst's dive into the BBC's ample archival files to examine its engagement with the novel medium of television in the 1920s and 1930s. The six chapters between the Introduction and Conclusion divide into four on the technical, commercial, political, and social effects of John Logie Baird's demonstrations and commercialization of a working, low-resolution, television system; and two chapters on the BBC's programming for the higher definition electronic television that it adopted in 1936. Chief engineer Dennis Eckersley summed up the issue of Baird's system in 1928: "I think to take up so much aether in the broadcasting band simply to give the small picture of the head and shoulders of a man to people who can afford £40 sets, is rather ridiculous." (p. 39)

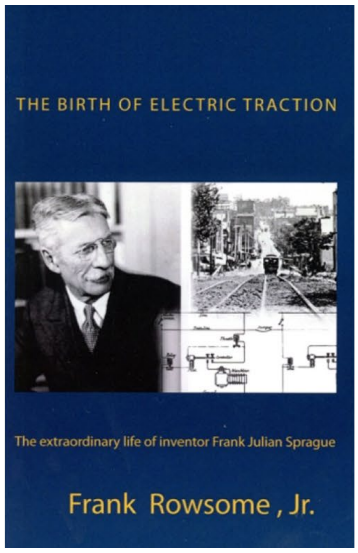
Medhurst discusses but does not detail the technologies or technical choices that the BBC's television engineers faced. For those readers could look to Donald McLean and R. W. Burns's writings. While recounting performers' resistance to working with the rigid and inconsistent Baird system, however, he provides a valuable set of contexts for the broadcast monopoly's contests with a determined entrepreneur. Baird and his investors pressed every lever of publicity, politics, and nationalism to exploit his firsts in transmitting grayscale images of people in real time, regardless of his approach's ultimate obsolescence. EMI's electronic system inevitably took longer to develop, and its superiority did nothing to improve funding for increased television programming or coverage beyond greater London before World War II. In this story one might draw lessons on the benefits and drawbacks of first movers in the process of innovation, at the time and in retrospect.

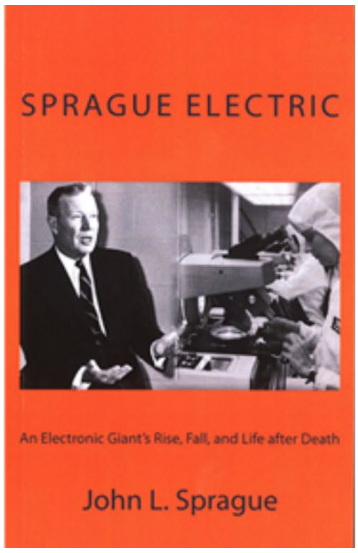
Available from Edinburgh University Press, Edinburgh, United Kingdom, +44 (0) 131-650-4218, **sales@eup.ed.ac.uk**, **https://edinburghuniversitypress.com/book-the-early-years-of-television-and-the-bbc.html**, $120.00, hardback, ISBN 978-0-7486-3786-7; $24.95, paperback, 978-1-3995-0411-9; $110.00, ePub, ISBN 978-1-3995-0413-3, 208 pp, index

BOOKS FROM THE IEEE HISTORY CENTER PRESS









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

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/Bell-Labs-Memoirs-Voices-Innovation/dp/1463677979

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

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-Electric-Electronics-Giants-after/dp/150338781X

IEEE History Center Press books are available from Amazon.com in hard copy and on Kindle

GIVING AND SUPPORT FOR IEEE HISTORY CENTER PROGRAMS

MAXWELL'S ETHER: FROM WAVE OPTICS TO THE ELECTROMAGNETIC THEORY OF LIGHT

Thanks to the support of donors to the IEEE History Center, a dedicated team of professional historians preserve, research, and promote the history of information and electrical technologies. One impact of this donor support was a virtual event in celebration of the 150th anniversary of James Clerk Maxwell's "Treatise on Electricity and Magnetism." During this session, the IEEE History Center and IEEE Foundation explored James Clerk Maxwell's revolutionary unification of light, electricity, and magnetism. The keynote speaker, Daniel Jon Mitchell DPhil., Senior Historian of the IEEE History Center walked the audience through the remarkable history of how Maxwell adapted the concept of an all-pervading ether to develop and ground his electromagnetic theory of light. Attendees learned how, in Maxwell's hands, the ether became a powerful theoretical tool to substantiate the electromagnetic field—through which he ultimately brought about a profound conceptual transformation of physical reality.

If you missed the session (or want to re-watch it), a recording can be found online at **https://ieeefoundation.org/MaxwellsEther**.

During the session, Dr. Mitchell, recommended the following books for those interested in learning more about Maxwell and his impact:

- *The Natural Philosophy of James Clerk Maxwell* by P.M. Harman
- *Innovation in Maxwell's Electromagnetic Theory* by Daniel M. Siegel
- *Imperial Science* by Bruce J. Hunt
- *Faraday, Maxwell and the Electromagnetic Field* by Nancy Forbes and Basil Mahon
- *James Clerk Maxwell Perspectives on his Life and Work* by Raymond Flood, Mark McCartney, and Andrew Whitaker

The IEEE History Center also hosts a variety of resources on James Clerk Maxwell:

- A biography of James Clerk Maxwell (**https://ethw.org/James_Clerk_Maxwell**)
- An extensive article on Maxwell's Equations (**https://ethw.org/Maxwell%27s_Equations**)
- Maxwell's Equations (**https://ethw.org/Milestones:Maxwell%27s_Equations,_1860-1871**) have been recognized as an IEEE Milestone in Glenlair, Scotland, and King's College London, UK
- A traveling exhibit on the history of electromagnetism (**https://ethw.org/w/images/c/ce/LinesandWaves.pdf**) and its applications has been displayed
- Free educational resources on the history of wireless communication **(https://reach.ieee.org/inquiry-units/radio/**) and radio broadcasting have been developed

IEEE LIFE MEMBER POSITIONS IEEE HISTORY CENTER AT THE TOP OF HIS CHARITABLE LIST

By Rich Allen, IEEE Foundation

IEEE Life Senior Member Paul Dorvel has spent more than thirty years in the electrical power industry focusing on high-voltage transmission lines but appreciates the varied challenges in other engineering fields too. One of the highlights of his career was traveling to Africa to promote photovoltaic-powered irrigation pumps. Paul is devoted to supporting the improvement of humanity through his profession.

Paul sees his donations on his membership renewal form as an extension of this work and often supports the IEEE History Center with his gifts.

"I find IEEE very valuable by keeping dedicated electrical engineers connected while supporting their ongoing learning," shares Paul. "I am besieged with requests to support this or that. All are worthwhile, but I rank IEEE near the top!"

Paul Dorvel

One of his current passions is mentoring younger engineers at the beginning of their power system careers. He supports students through the HKN Fund but also sees his contributions to the IEEE History Center especially important as it "reminds us of the development arc traced from simplistic slide rules to complex supercomputers."

Paul received his bachelor's and master's degrees in electrical engineering from Stanford University. He spent the first two decades of his career at R.W. Beck and is now a project manager at Leidos Engineering based in Seattle, WA, U.S.A. He has been donating through his IEEE member dues renewal form since 1999. You can join Paul by making a gift to the IEEE History Center at **ieeefoundation.org/donate_history**.

RUSSELL WINS FINN IEEE PRIZE FOR BEST ARTICLE ON ELECTROTECHNOLOGY HISTORY

The 2023 Bernard S. Finn IEEE History Prize, formerly known as the IEEE Life Members' Prize in Electrical History was awarded to Professor Edmund Russell. The prize is supported by the IEEE Life Members' Fund, administered by the Society for the History of Technology (SHOT), and honors Barney Finn, long-time member of IEEE's History Committee and curator emeritus of the Electricity Collections at the Smithsonian Institution's National Museum of American History.

Russell's paper "Capitalism Matters: How Financial and Technological Innovations Shaped U.S. Telegraphs, 1845–60," was published in *Technology and Culture* 63, no. 1 (2022). To quote the prize committee chaired by IEEE History Center outreach historian Alexander Magoun, "[Russell's] research into the early financing of telegraph networks leads him to argue that historians of technology should make capitalism, particularly its financial aspects, a major theme in writing on innovation."

Russell is the David M. Roderick Professor of Technology and Social Change, and Professor of History, at Carnegie Mellon University. He is writing a history of the transcontinental telegraph. His email is **edmundr@andrew.cmu.edu**. His article complements a remarkable project constructed online with cartographer Lauren Winkler and the assistance of many students, "Uniting the States with Telegraphs, 1844-1862," hosted by CMU Libraries at **https://telegraph.library.cmu.edu/**. Professor Russell recorded an engaging presentation on the project with Magoun's assistance that is hosted on the History Center's engineering history YouTube channel: **https://www.youtube.com/watch?v=QENstCNgcV4**.

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**)

IEEE Foundation

IEEE

Where technology and philanthropy intersect

Together, we deliver opportunity, innovation and impact across the globe.

As the philanthropic partner of IEEE, we translate the values of our members and donors into social impact. In collaboration with IEEE, we connect more than 200 member-led initiatives with financing, expertise and philanthropic guidance. Help advance the IEEE mission with a donation.

Funds and Programs:

- IEEE PES Scholarship Plus Initiative
- IEEE History Center and REACH
- EPICS in IEEE
- IEEE Smart Village
- And many more!

Join Us!

To find your program, visit
ieeefoundation.org/what-to-support

To make a donation, visit
ieeefoundation.org/donate

Illuminate

Educate

Engage

Energize

Future

ieeefoundation.org

IEEE History Center
445 Hoes Lane
Piscataway, NJ 08854

The History Center thrives with YOUR support.
Making a *safe* and *secure*
online gift to the IEEE Foundation —
History Center Fund has never been easier!

You can support IEEE's historical
activities by clicking on
www.ieeefoundation.org/impact/illuminate/ieee-history-center/
and choosing **"IEEE History Center Fund"**
at the **"Designation"** box.