IEEE History Center

SPECIAL ISSUE ON THE IEEE ARCHIVES

STEVENS
INSTITUTE of TECHNOLOGY
THE INNOVATION UNIVERSITY

SIGNALS FROM THE DIRECTOR

By Michael N. Geselowitz, PhD

Long-time supporters of the IEEE History Center will notice a change in this issue of the *IEEE History Center Newsletter*. Several years ago, for a number of reasons, we switched from a three-times-per-year print newsletter to a newsletter that was sent electronically twice a year with one print issue. Because in those days we published our Honor Roll of donors in print, and because the first issue of each year seemed the first and best opportunity to recognize our supporters from the previous year, March became the print issue of the year. More recently, the IEEE Foundation, which holds our philanthropic funds and assists us in fundraising, citing industry standards and confidentiality, recommended that we no longer publish the list of donors (they also ceased publishing an overall donor list for the IEEE Foundation).

Without the Honor Roll, we decided that the midyear newsletter issue in July would be the best opportunity to engage our subscribers, and would be a better month for a print issue. A print issue affords an opportunity to

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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/**

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

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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/Oral-History:List_of_all_Oral_Histories**

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.

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: 500–1200 words. Submit to **ieee-history@ieee.org**. Articles and letters to the editor may be edited for style or length.

really grab readers' attention with exciting graphics and interesting stories. Because of the cycle of IEEE meetings and activities, March is relatively early to be reporting accomplishments. Those of you reading this issue on a screen can look forward to holding a hard copy of its successor in July.

Although it is only February when this issue is put to bed, we have not been standing still! The History Center's programs—REACH, Milestones, Oral Histories—continue to thrive, as you can observe in articles throughout this issue. The most exciting development is the "IEEE Global Museum Project." As reported in earlier issues, IEEE Life Fellow, active IEEE volunteer, and long-time History Center supporter John Impagliazzo gave us generous gifts over the past three years to enable us to enhance the historical displays at IEEE venues around

the world. This initial activity has evolved into the concept of an IEEE Global Museum. The IEEE History Committee intends to approach the IEEE Board of Directors about increasing the IEEE's commitment to the History Center in 2021. In the meanwhile, the IEEE Life Members Committee has given us a generous grant for this year to continue the momentum of the program.

In the meanwhile, it is primarily generosity of you, our supporters, that enables our programs to preserve and make known the history of IEEE, its members, your industries and professions, and the related technologies. Whether the gifts come directly to the History Fund, or indirectly as grants from other donor-supported funds in the IEEE Foundation, we thank you profusely.

IEEE VOLUNTEERS ACTIVELY PRESERVING HISTORY

In this issue, we continue our series profiling the history activities of IEEE units and learn how they preserve and promote the heritage of the profession.

YOUR IEEE-RELATED PAPERS ARE WORTH SAVING: THE IEEE HISTORY CENTER IS THE PLACE

By Don Heirman

The purpose of this article is to show the importance to IEEE of preserving technology-significant members' papers, and why I believe it is vital to support the IEEE Archives in its mission. I use "papers" as a generic term that includes hard copies (or scanned electronic versions) of documents, plaques, awards, biographies, photos, mementos, medals, and the like. Archiving preserves the history of key activities of organizations, explains what made the difference in the past so that those techniques can be applied in the future, provides a resource for researchers, and remembers those involved in the work.

To be most useful, archived materials need to be digitized. This permits complete key word searchability, which is crucial for researchers.

Don Heirman discusses preservation with IEEE History Center Staff in the IEEE Archives

Any handwritten comments on documents will need good optical character reading capability for capture. Documents should be stored as PDF files to ensure no changes are made and to preserve the historical integrity of the content. Photos will need electronic capture as well. Details such as location and dates should be added if they are not already contained in the written material.

I am entering my papers into a special collection at Purdue University's Library Archives. They include selected papers I have written or used as part of the history of the IEEE EMC Society history. But I do not want to stop just supporting EMC history. Early on I talked with the IEEE History Center to support its important work of capturing key electrical and electronic historical work the Center is doing but at

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SUBSCRIPTION INFORMATION

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

IEEE VOLUNTEERS ACTIVELY PRESERVING HISTORY

the IEEE-wide level.

I invited Nathan Brewer and Mary Ann Hellrigel of the IEEE History Center to visit my office. While there, they found many items which are candidates for accessioning in the IEEE Archives. The items included a wide array of IEEE pins, plaques, award certificates, and photos of IEEE leadership. I want to preserve this organizational history, and have agreed to donate all that I have kept over the years as I moved through the IEEE.
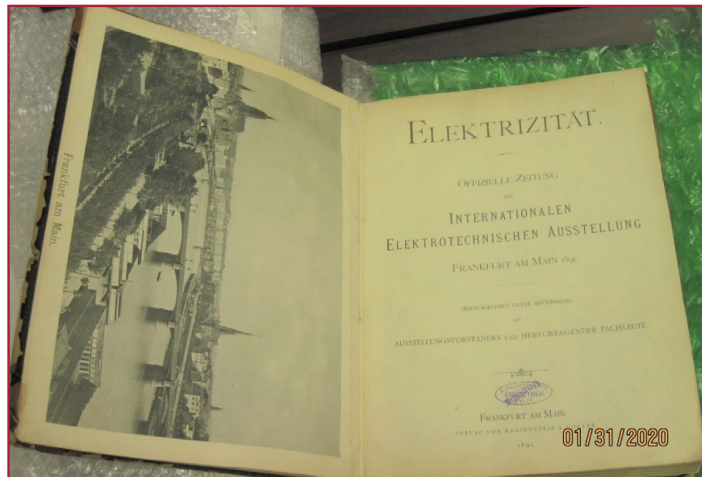
SUPPORT THE IEEE ARCHIVES

IEEE Archives staff will then work with the prospective donor on the details of whether the material duplicates material already in the collection or is better suited for another collection.

Summary:

The IEEE Archives welcomes contacts about donations of materials **ieee-history@ieee.org**. When contacting the IEEE History Center about possible donations of materials, it is helpful to include the following:

1) How much material (e.g., how many boxes or linear feet for papers and a sense of material which is 3-dimensional, such as wall plaques, pins, medals, etc.).

2) An inventory or finding aid.

3) Present location of the materials (so that IEEE Archive staff can figure out shipping and other logistics).

"THE ONLY COPY ON THIS SIDE OF THE ATLANTIC": MAJOR ADDITIONS TO THE HISTORY CENTER LIBRARY

The IEEE History Center library has received several donations since the last newsletter, two of which deserve special notice. Professor Adam Allerhand, author of the authoritative *Illustrated History of Electric Lighting* (2015), has become a frequent contributor to the Scanning Our Past section of *Proceedings of the IEEE*, for which outreach historian Alex Magoun serves as editor. Last year Prof. Allerhand decided to write an article on pioneering long-distance

transmission of three-phase, alternating current, electricity. The 1891 International Electrotechnical Exhibition in Frankfurt played a central role as the first recipient of this now standard form of electric power, and he acquired a bound set of the exhibition's newspaper, *Elektrizität*, for his research. When Allerhand finished his article (**https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8944322**), he asked Magoun if the History Center would like the volume.

This question had an easy answer but it raised another one: who else has it? A search of WorldCat and other online catalogs revealed three copies in German libraries and a similar title at the Library of Congress. The latter, however, is a bound collection of print illustrations of the exhibition from the IEEE's portion of Engineering Societies Library once stored at the United Engineering Society building in New York City. "We're extraordinarily grateful that Professor Allerhand donated this volume to the center," says Magoun. "As the only copy on this side of the Atlantic Ocean and a historic record of electrical development and promotion that even IEEE's Wheeler Gift collection (now at the New York

Public Library) doesn't have, we hope that a future Elizabeth & Emerson Pugh Scholar will take advantage of its availability."

Move forward 90 years, to 1981, and west to Silicon Valley in California where Adam Osborne introduced the Osborne 1 portable computer. In mid-1982, following its success, Osborne initiated *The Portable Companion*, a magazine for its thousands of users. The first issue features the remarkable photo of journalist David Kline with his Osborne 1 on the North-West Frontier Province of Pakistan (now Khyber Pakhtunkhwa), posing with local militia members. Kline later wrote for *InfoWorld* (**https://bit.ly/36Wn3SG**) on how portable computers and digital networks were revolutionizing the roles of independent journalists in conflict zones.
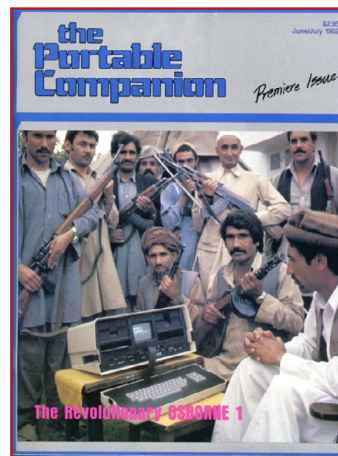
Dr. Gary Frost, one of the Center's Life Member Fellows in Electrical History, donated this and other early issues of the magazine along with other primary and secondary history publications. He selected these in consultation with Magoun, who says, "Gary has always been a model scholar, sharing his expertise and research with colleagues. This gift is just the most recent example of his generosity."

IEEE ARCHIVES WISHLIST

The IEEE Archives is a repository for IEEE institutional history and records. We aim to collect several classes of records, publications, and ephemeral material generated by the institute. Examples of what the archives aims to collect include:

- IEEE Organizational Unit administration records and minutes

- Conferences and journals which have not been digitized in IEEE Xplore

- Photographs and multimedia of award ceremonies or IEEE events

- Newsletters covering IEEE activities

If you have similar material and would be interested in donating it to the IEEE Archives, please email **ieee-history@ieee.org**.

SECTION, SOCIETY, AND OTHER IEEE UNIT NEWSLETTERS NOW AVAILABLE ON THE ETHW

Newsletters are one of the most important types of publications for tracking the history of an organization. As IEEE has numerous volunteer organizational units, including, but not limited to, sections, societies, chapters, and student branches, these publications are essential for documenting the day to day operations and activities.

Several runs of IEEE newsletters have been scanned from our archival holdings and posted on the ETHW.

Recently updated collections include:
Staff Circuit and Network News: an IEEE Employee Newsletter
https://ethw.org/Archives:The_Staff_Circuit_-_Network_News

IRE Denver Decibel, Western Engineer Newsletter, RockIEEE Overlook Newsletter: Denver Section newsletters
https://ethw.org/IEEE_Denver_Section_History

Pulse of Long Island: Long Island Section Newsletter
https://ethw.org/IEEE_Long_Island_Section_History

National Capital Area Council Scanner:
https://ethw.org/IEEE_National_Capital_Area_Council_History

The Scoop: Member and Geographic Activities newsletter
https://ethw.org/IEEE_Member_and_Geographic_Activities_Board

Engineering Management Newsletter: Technology and Engineering Management Society newsletter
https://ethw.org/IEEE_Technology_and_Engineering_Management_Society

IEEE IMPACT: IEEE-USA Newsletters
https://ethw.org/IEEE-USA_History

Life Members Newsletter
https://ethw.org/IEEE_Life_Members_Committee_History

The IEEE Archives is always looking for additional IEEE newsletters to expand our collections. If you have any newsletters that are not present on the ETHW, please contact **ieee-history@ieee.org**

TECHNOLOGY UNEXPECTANS

A Department that explores Technology in Unexpected Contexts

HAMILTON, QUATERNIONS, AND THE BROOME BRIDGE: AN ACT OF MATHEMATICAL VANDALISM

By Vasudevan Lakshminarayanan, IEEE History Committee

On 16 October 1843, Irish mathematical physicist, Sir William Rowan Hamilton (1805-1865) and his wife, Helen Maria Bayly, were walking along the Royal Canal near the Broome Bridge in Dublin, Ireland. The Broome Bridge, (*Droichead Broome* in Irish), also called the Broom Bridge or the Brougham Bridge, crosses the Royal Canal in Cabra, north Dublin, and was named after William Broome, one of the directors of the Royal Canal Company.

Hamilton had been working on defining the multiplicative operation of points in three-dimensional space rather than on a plane. While crossing the bridge, Hamilton thought of a solution to this problem. Describing it in a letter to his friend, mathematician John Graves, Hamilton wrote, "I then and there felt the Galvanic circuit of thought close, and the sparks that fell from it were the fundamental equations between I, j and k, exactly such I have used them ever since". He discovered that even though he could not multiply triples, he could multiply quadruples, using the basic rules of what he later named as quaternions, namely, $i^2 = j^2 = k^2 = ijk = -1$.

In an act of mathematical vandalism, Hamilton carved his formula into the stone of the bridge. Even though the original graffiti is long gone, there is a plaque erected in the 1950s commemorating this discovery. It should be noted that the formula for multiplication is implicit in the four-square formula of Leonhard Euler (1748), and Olinde Rodrigues (1795-1851)
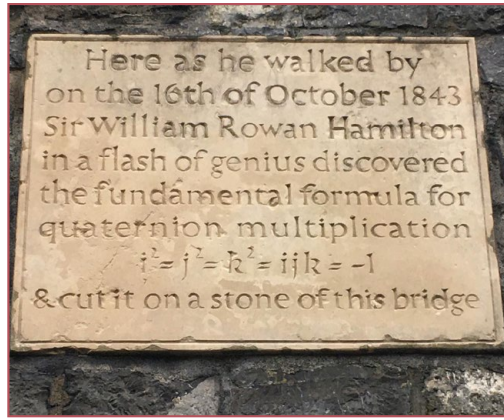
applied this formula to represent rotations. Hamilton's major contribution was to express them as a non-commutative rotation algebra. He published a number of papers on this subject, culminating in a classic textbook, *Elements of Quaternions*. Hamilton also made fundamental contributions to optics, mechanics and other areas of physics.

Quaternions have been used extensively in a number of areas of physics and engineering, including robotics, control systems, aeronautics and spaceflight guidance, computer graphics, signal processing, bioinformatics, and even in the study of eye movements.

The date 16 October is referred to as Broomsday in analogy to 16 June "Bloomsday" referring to James Joyce's novel *Ulysses*. In 1958, the Dublin City government renamed the bridge in honor of Hamilton, but the original name is still used. One can reach the bridge via the LUAS tramstop serving Cabra, Dublin 7.

HISTORY CENTER IN ACTION: SHAPING THE FUTURE BY PRESERVING THE PAST

STEVENS COURSE SPRING 2020: "UNINTENDED CONSEQUENCES"

Once again, a member of the History Center staff is teaching a course in the College of Arts & Letters (CAL) of our educational partner, Stevens Institute of Technology. The course is CAL 105, "Knowledge, Nature, Culture," and the instructor is Senior Director Michael Geselowitz.

CAL105 is a required freshman seminar meant to expose Stevens undergraduates---primarily engineers!—to the range of the approaches of the humanities and social sciences (including history!) to understanding the world. The course is also reading and writing intensive. This helps Stevens fulfill several criteria necessary for ABET accreditation, especially that students receive "broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context."

Faculty teaching CAL105 can pick any topic of interest in their research to use as the lens through which to do view a wide range of multidisciplinary approaches. Since Geselowitz will be traveling a great deal on IEEE business, rather than relying on haphazard guest lectures, the History Center staff collectively chose a topic for which each member of the History Center staff could deliver a class in the area of their expertise. We came up with "The Unintended Consequences of Technology," a fitting topic for young engineering students who are going to go out into the world looking to innovate. As of this writing, the course has only just begun, but, so far, the two sections of 25 engineering students each seem both intrigued and surprised by what they are learning.

IEEE REACH CONTINUES TO GROW

2019 was a busy and successful year for IEEE REACH. In addition to adding a new lesson plan on Electronic Music and five new student videos (two on Electric Light and three on Skyscrapers), by the end of the year more than 1,000 subscribers had signed up for the program. The subscribers consist of teachers and education administrators from a wide array of educational markets from both the Social Studies and STEM (Science, Technology, Engineering, Math) disciplines. Sixty-three percent of the subscribers are high school and middle school teachers, followed by twenty percent university professors from both the engineering and education disciplines, and the remaining seventeen percent are a combination of elementary educators, administrators across all grade levels, museum and library personnel, in addition to members and friends of IEEE

REACH. They hail from every state, except two, in the United States, and from forty-three countries!

As the world population grows and technology continues to advance, a holistic understanding of technology and its effects on society is crucial. "Students will be asked to make decisions that influence the development of technologies and the direction of scientific research that cannot be imagined today," according to the United States Next Generation Science Standards. This is true for all students, whether they choose a STEM career or not. Yet, in 2018, the US National Assessment of Educational Progress, assessed 8th grade students for technology and engineering literacy, and more than 53% of the students fell below the proficiency level. Society and Technology is one of the three focus areas of the assessment. This assessment explains why programs like IEEE REACH are so important.

One of the best ways to get students interested in the topic is through history. History not only provides narratives from which students may learn and garner interest, but the history of technology, in and of itself, is cross-cutting in nature, and specifically informs how technology, throughout time, has impacted society, politics, economics, and culture. This rich historical approach is exactly what is provided in the IEEE REACH resources. The IEEE REACH program assists teachers with making the society and technology connections come alive in the classroom so that students are engaged not only in the technology of the past and understanding its role in society, but also so students may address real-world applications of the technology of today and the future.

If the short history of the program is any indicator, REACH will continue to grow in content and usage every year. Most of the growth so far has come from the REACH team exhibiting and

presenting at educator conferences. For example, in November, members of the IEEE REACH team attended the National Conference of the Social Studies where hundreds of teachers were introduced to the program. On Friday, 13 March, the REACH team will be presenting at the International Technology and Engineering Educators Association's annual conference in Baltimore, Maryland. The program is also marketed to teachers across the country, and internationally, via a digital advertising campaign.

While the program is gaining traction with teachers around the globe, the program continues to need funding. In 2020 the REACH team intends to pursue corporate underwriting, in the hopes of sustaining the program for the next 3-5 years. This funding will aid the growth of the program both in content and in reaching even more teachers and students. If you are aware of any corporations who are interested in ensuring the next generation is technologically literate, please forward that information to the IEEE REACH Program Manager, Kelly McKenna **k.mckenna@ieee.org**. In addition, the REACH team and the IEEE History Center encourage you to share the program with your local school districts. Kelly can provide a PowerPoint presentation to any volunteer who wishes to share the program with a school. In addition, please show one of the latest videos on the Electric Light or Skyscrapers to a young person you know and help them begin their journey toward understanding the connections between technology and society.

As always, we are grateful for all of your efforts with IEEE and any assistance to help grow the IEEE REACH program. Be sure to check out the new student videos about Edison and electric lighting, and those on skyscrapers and the elevator. All may be found here: **https://reach.ieee.org/multimedia/** (The first five videos are the new ones.)

LIST OF TECHNICAL ACHIEVEMENTS BY WOMEN FOR PROPOSAL AS IEEE MILESTONES

In hopes of encouraging the proposal of IEEE Milestones reflecting the contributions of women to IEEE's fields of interest, IEEE History Center staff have researched and presented a table of technical achievements by women that would be suitable for proposal. **http://ieeemilestones.ethw.org/List_of_Achievements_Suitable_for_Milestones_featuring_Women** This list is not intended to be comprehensive, but to begin the discussion.

History Center staff are also building an online self-guided technical tour of places associated with Grace Hopper and her work. When completed, it will be mounted on the ETHW. **https://ethw.org/Technical_Tours**

DONOR PROFILE: CHERIF AMIRAT

MEMBER GRADE: Senior Member

Pursuing His Interests and Making A Difference

As Chief Information Officer at IEEE, Dr. Cherif Amirat has proven that he's not only a valued member of the professional team, but a loyal member and donor as well.

"I first joined IEEE when I was a Ph.D. student and that helped me access published research and in turn publish my own papers," Cherif said. "As a professional, I got to see and appreciate the IEEE mission of fostering technological innovation and excellence for the benefit of humanity, which resonates with what I value. IEEE is beyond staying current with technology, professional networking and career advancements — it truly impacts how technology evolves and serves humanity."

Over the years, Cherif has donated to many IEEE initiatives and has enjoyed the opportunity to learn about each one along the way. "The IEEE Foundation drives so many valuable and impactful initiatives and programs and I support a different one each year," he explained. "For 2019, I donated to the History Center; after having a chance to visit the Center and learn more about the work they do, including the Milestones program, I wanted to contribute to their mission."

In addition to donating through IEEE's 'employee giving' payroll mechanism, Cherif has also capitalized on matching programs offered by former employers to make his donations go even farther. Since retiring from Pfizer Inc., for example, "they match 50% of all of my charitable contributions and I take full advantage of this benefit," he said.

Overall, Cherif can't say enough about the importance of contributing to IEEE. "No matter your interest, you'll find an IEEE initiative that will match it," he said. "I encourage others to get involved to make a difference."

RELIC HUNTING

PROGRAMMING CLAUDE SHANNON'S 1961 MINIVAC 6010

By Michael Dasaro,
IEEE History Center Research Assistant

In 1961 the Scientific Development Corporation (SDC) sold the Minivac 601 for $85. It was a basic computer for educational purposes that was mostly received as a toy and didn't sell very well. An update the following year revealed the far more successful Minivac 6010, an "advanced and improved version." The new model looked more sophisticated with a gray metal case rather than the 601's blue painted case. It came with more cables and special resistors, diodes, and capacitors. The price was raised dramatically to $235. This appealed to businesses for training purposes, and it sold well. The original instruction manual was friendly, simple, and informative, providing complicated electrical diagrams along with easy-to-understand written instructions. Electrical relays and logic switches allowed basic programs to be created that used the input buttons, switches, and a dial, outputting to lights or turning the dial.

Last summer, the IEEE History Center was privileged to receive a 6010 from Arnold Amstutz, the entrepreneur responsible for its innovation, to support outreach historian Alex Magoun's Histelcon paper on Claude Shannon's personal computer.

Using this form of electromechanical programming is somehow more satisfying than modern languages and makes the electrical diagrams remarkably intuitive. Born in 2001, I've never experienced punched-card programming or anything simpler than a Windows XP machine, but using the Minivac was shockingly reminiscent of another programming experience of my childhood: Minecraft. I'm fluent in Java, Python, C, HTML/CSS, Basic, and Lua, but using the Minivac doesn't feel like programming in any of these. It does however directly remind me of the "physical" programming using Redstone in the game Minecraft. I didn't understand it a decade ago—tinkering with pistons, lights, and wires known as Redstone in the game to make a door open—but I was learning basic binary programming through a video game's representation of electricity.
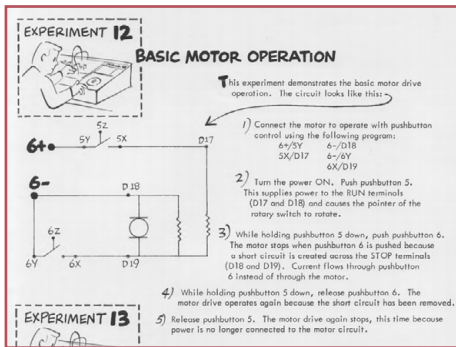
Looking back, the simplified yet infinitely scalable technology in the game is a great way to intuitively understand electricity and binary programming. Once I understood the Minivac's capabilities I began looking through the instruction manualsand came across a tutorial on creating a random number generator (wiring pictured above). I immediately remembered building one of my first Redstone creations in Minecraft: a random number generator simulating rolling a die. I had a loop of wire running with delays, so that at any time the power was in one of six places (changing all the time), then there was a button that, when hit, would move pistons, allowing the signal through, wherever it was, which would move pistons on a 3x3 grid, creating the pattern seen on the die. The wiring was tremendously messy and its construction took me hours, but I was proud of the creation, and something about building a virtual "physical" program was far more satisfying than the modern method I learned years later: print random.randint(1,6). I think programming on the Minivac 6010 is a great experience for a computer scientist or engineer of any era, and I also maintain that anyone of any age would enjoy the experience of tinkering with Redstone in Minecraft to better understand how basic binary inputs eventually evolved into the immensely complicated computers we have today.

Sources:

http://www.ccapitalia.net/descarga/docs/1961-minivac601-book1.pdf

http://www.computinghistory.org.uk/det/499/minivac-601/

Alexander B. Magoun, "Claude Shannon's Computer: The Origins of the Minivac 601," 2019 IEEE History of Electrotechnology Conference (Histelcon), Glasgow, 18-19 September 2019 (forthcoming).

STAFF NOTES

MICHAEL DASARO AND SABIN THAPA ARE THIS YEAR'S RESEARCH ASSISTANTS

Michael Dasaro is a first-year student at Stevens Institute of Technology, pursuing a Bachelors of Engineering in Computer Engineering with a focus in Robotics and Automation. He is also participating in the Stevens Accelerated Masters Program and the Cooperative Education Program; planned graduation is May 2023. His interests include robotics, computers, programming, cyber security, and circuits. He has been working part-time as a Research Assistant at the IEEE Historical Center since October 2019, assisting in research for lectures and IEEE milestones, writing articles, and cataloging books.

Sabin Thapa, a freshman from Queens studying mechanical engineering, hopes to work in the aerospace industry. "Ever since I could read, I had always been fascinated by space. A few years ago, I realized that engineering gave me a path that combines my interests in science and my creative art side. We are headed to a new age of space exploration with many exciting projects already in motion for the upcoming decade. It is something I would love to be a part of.

"Although I have always loved art and science, history holds a place in my heart. I won the Silver Medal in Social Studies at Brooklyn Technical High School for having the 2nd highest GPA in social studies courses. As an avid Jeopardy viewer, this knowledge comes in handy! I've always been a dreamer. As an engineering student, I dream of the future and what can be. As a lover of history, I imagine the past and how things came to be. My time at the IEEE History Center has taught me about the tireless efforts of men and women who have contributed a great deal to bring us where we are today. I am honored to help celebrate their dedication and recognize their work."

Sabin has been building online self-guided technical tours of Ottawa and of places associated with Grace Hopper and her work on the Engineering & Technology History Wiki https://ethw.org/Technical_Tours

TECHNOLOGY HISTORY ON THE WEB

TECH HISTORY ON THE WEB – RECENT STAFF FAVORITES

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

Images of women in the Space Age collected by NYSci: https://nysci.org/imaging-women-in-the-space-age/

A Chronology of the history of computers from Live Science: https://www.livescience.com/20718-computer-history.html

To celebrate the 125th anniversary of x-rays, a blog on radiology and medicine: http://www.jfma.fr/pages-english-selection.html

Battlefield Communicators for Jerusalem: 1947 and 1967 Wars

By IEEE Senior Life Member Col (ret) Dr. Jacob Baal-Schem

In Hebrew: **http://amutakesher.org.il/_Uploads/dbsAttached Files/combinepdf.pdf**
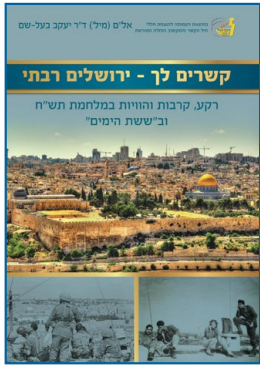
On 29 November 1947 the United Nations General Assembly approved the Partition Plan for Palestine, placing Jerusalem under international rule. For the young student Jacob Baal-Schem it was clear that he should participate in the battle for including Jerusalem in the Jewish state. As a member of the "Haganah" – the Jewish clandestine military organization, he immediately volunteered for duty and was sent to a course for battlefield communicators and served thereafter for thirty years in the Israeli Signal Corps.

The book tells the story of the main battles in and around Jerusalem in which Baal-Schem participated as a Battlefield Communicator. Fighting in and around Jerusalem broke out immediately after the UN resolution. Beginning in February 1948, Arab militia blockaded the road from Tel-Aviv to Jerusalem, preventing the supply to the 100,000 Jewish inhabitants of the city. This blockade was broken in mid-April by operations described in the book.

A remarkable event mentioned tells how a single radio message, informing the exhausted fighters about the possible withdrawing of Arab militia from their assault towards the San Simon Monastery in Katamon, became the turning point in liberating the central district of the city of Jerusalem. The second part of the book tells how the city, divided by the end of the Independence War in 1949, was reunited during the 1967 Six Day War, showing the important role of the communication servicemen in modern battle.

The book emphasizes the importance of communications in military activities, from the use of homing pigeons to modern AM/FM communication. A German WWII light-wave communication system was used to keep contact between the guards of the besieged Hebrew University on Mount Scopus and the headquarters at the center of Jerusalem.

Jacob Baal-Schem served from 1948 until 1978 in the IDF and his last duty was Deputy Chief Signal Officer of the IDF. After retiring from military service, he was elected Chairman of the IEEE Israel Section, initiated the MELECON and HISTELCON Conferences and served in many IEEE Committees. He was awarded the 1987 Larry K. Wilson Transnational Award and the IEEE REGION 8 volunteer Award. He is Chair of the IEEE Israel Life Members Affinity Group.

FROM THE IEEE HISTORY CENTER PRESS

SPRAGUE ELECTRIC: AN ELECTRONIC GIANT'S RISE, FALL, AND LIFE AFTER DEATH
by John L. Sprague
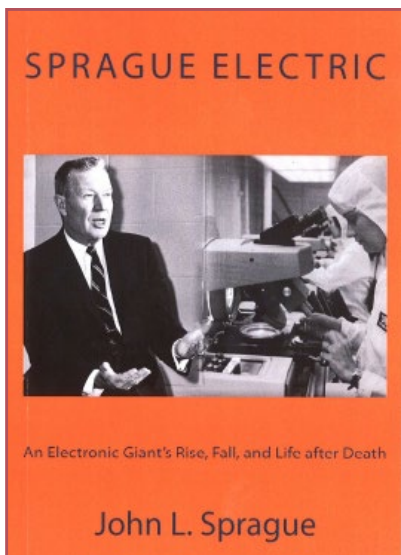
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