

# IEEE life members newsletter



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## Should Life Membership Be Extended Beyond Its Current Boundaries?

Charles W. Turner, Chair, IEEE Life Members Committee

The IEEE Board of Directors defined the qualifying rules for IEEE Life Membership in 1964. IEEE Life Members (LMs) do not pay annual dues and regional assessments and may receive selected IEEE Society publications free of charge. The criteria laid down at that time (LMs must have reached the age of 65 and been an IEEE member long enough that the sum total of their age and years of membership equals or exceeds 100) have remained unchanged. Today, many members over 65 do not qualify for Life Membership because they joined the IEEE in mid-career. This is especially true in the IEEE Sections outside North America that were formed relatively recently. It has raised the question of whether it would be timely to review these criteria and consider proactively welcoming the wider community of older members to join in LM activities.



**IEEE Life Members Committee Chair Charles W. Turner**

The demographics of IEEE membership are changing: the number of LMs currently exceeds 38,000 and is enjoying sustained growth. Clearly, any proposal to relax the qualifying criteria and extend the dues/assessment waiver would have a financial impact on the IEEE General Fund and the budgets of Regions and IEEE entities such as IEEE-USA. Retired members and those on low incomes already benefit from reduced dues; if other members were to qualify for an age-related reduction that would also affect IEEE's dues income.

An additional strategy that avoids this problem would be to induct all mem-

bers over a certain age into a new category of membership, with appropriate benefits and privileges, but without waiving dues. It is possible that this might improve the retention of retired members, who commonly regard membership as offering limited benefits to those who have not remained technically active or lost contact with former work colleagues.

There is also the question of whether the IEEE should welcome retired members of other engineering and scientific societies, perhaps granting nominal status for a small annual fee. The potential benefit to the IEEE would be that the level of participation in activities in Sections with relatively few LMs would increase and make them more viable. Some LM Affinity Groups (LMAGs) currently invite non-LMs to their meetings and social events.

### The Key Role of LMAGs

The IEEE Life Members Committee (LMC) has continued to give high priority to the formation of new LMAGs and provide greater financial support for existing groups. The total number of LMAGs has reached 100 and is increasing steadily. However, there are over 330 Sections in the 10 Regions across the world. Many Sections with large numbers of LMs are still without an LMAG, which represents a missed opportunity to improve service to older members.

LMAGs have direct access to the funding resources needed to organize meetings



and other events. This year, the LMC decided to increase this funding to help LMAGs offer more ambitious programs for their members. Without the active support of an LMAG, LMs are completely reliant on the Section administration for meetings and events to serve their interests. A newly formed LMAG can access “start-up” funding for its program of activities. All LMAGs can apply for up to a maximum of US\$2,000 each year for approved activities organized for the benefit of LMs. An LMAG can also create new opportunities for volunteer leaders, coordinate events, and collaborate with other IEEE entities, such as Student Branches, IEEE Young

Professionals, and IEEE Women in Engineering Affinity Groups. Importantly, an LMAG provides LMs visibility in the Section and helps to improve the quality of the membership experience for all long-serving members.

LMs can take the initiative to form an LMAG via a petition, which requires the signatures of six higher-grade members, including an LM organizer. You may submit a petition at [iee.org/communities/life-members/groups](http://iee.org/communities/life-members/groups). LMC members and the 10 Regional coordinators are ready and willing to help the LMAGs, as well as individual LMs, to enjoy continued participation in the IEEE.

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## IEEE History Center, IEEE-USA, and U.S. Patent Office Collaborate on Intellectual Property

The U.S. Patent and Trademark Office (USPTO) invited the IEEE to be the sole exhibitor at its 23 July 2019 event, “Apollo 50: The Role of Intellectual Property in Space Commerce.” IEEE-USA, the IEEE History Center, *IEEE Spectrum*, and IEEE Technical Activities Entrepreneurship group collaborated to raise the IEEE’s visibility within industry and government. This was part of the FOOTSTEPS program, the IEEE’s commemoration of the Apollo Moon landings, and the celebration of the contributions made by its members to human space-flight technologies.

The event was a tremendous success. More than 900 people attended, double what the USPTO expected. Administrator Jim Bridenstine of NASA gave the keynote address. The IEEE History Center displayed copies of seminal patents issued to IEEE members, demonstrating their role in innovation. The book of patent copies garnered significant traffic throughout the event, and visitors took photos of its pages. The IEEE History Center also provided a slide show of photos and patents, which generated positive reactions and plenty of visits.

IEEE-USA sponsored the Virtosphere, a virtual moonwalk originally developed in 2018 for CES, the international consumer electronics trade show held annually in Las Vegas. Attendees were able to take a 2.5 min virtual moonwalk, emphasizing the IEEE’s contributions to the technologies that made Apollo possible. Virtosphere inventor and owner Ray Latypov met and spoke with NASA Administrator Bridenstine and PTO Director Iancu as well as the same PTO patent examiner who reviewed and approved his patent application years ago.

“Our job here in the IEEE-USA Washington is to build bridges and nurture relationships with the federal regulators and legislators who impact the lives and careers of IEEE’s engineers and scientists,” says Erica Wissolik, senior program manager, IEEE-USA Government Relations.



*The Virtosphere allowed event attendees to experience a virtual moonwalk.*



*IEEE History Center Historian Lisa Nocks promoted IEEE’s contributions to the technologies that made Apollo possible.*

“Events like [this] ensure that Washington’s doors and ears are always open to us so that we can successfully influence the public policies affecting the S&T [science and technology] community.”

One of the ways the IEEE History Center has been preserving and promoting the technical contributions of IEEE Members is by collecting oral histories and first-hand histories of members who developed space technologies. These can be found at the Engineering and Technology History Wiki (ETHW) at [https://ethw.org/Human\\_Space\\_](https://ethw.org/Human_Space_)

[Travel\\_Primary\\_Sources](#). The IEEE History Center invites members who would like to contribute their first-hand experiences to visit the ETHW at <https://ethw.org/Create>. The ETHW uses a different login from your IEEE username and password. An ETHW login can be obtained by clicking on the “Account” tab in the blue bar at the top right of the page.

Robert Colburn  
IEEE History Center Resource Coordinator

## AHF Launches “Oak Ridge Innovations” Program

**N**uclear medicine, nuclear energy, nuclear weapons. All of that goes back to Oak Ridge,” explains Denise Kiernan, bestselling author of *The Girls of Atomic City*. Oak Ridge, Tennessee, has been a center for nuclear research since General Leslie Groves selected it as the Manhattan Project’s uranium enrichment site in 1942. Today, Oak Ridge is the home of many leading scientific and engineering research facilities, including Oak Ridge National Laboratory (ORNL).

The Atomic Heritage Foundation (AHF) launched a new online interpretive program, “Oak Ridge Innovations,” to explore Oak Ridge’s legacies for science and society today. Available at AHF’s “Ranger in Your Pocket” website (<https://www.atomicheritage.org/tours>), “Oak Ridge Innovations” includes more than 30 video vignettes describing ORNL’s history and current research in fields such as energy, particle physics, computer science, and medicine. The program was developed in partnership with the IEEE East Tennessee Section and funded by the IEEE Life Members Fund of the IEEE Foundation. Featuring perspectives from current ORNL scientists and Manhattan Project veterans, the program illuminates Oak Ridge’s history and how the laboratory responds to some of today’s biggest challenges.

“This program connects the dots between Oak Ridge’s role in the Manhattan Project and its cutting-edge research today,” states AHF President Cynthia C. Kelly. “It will be a valuable educational tool for students and audiences around the world.”

Throughout the program, scientists discuss different global problems and how they work to solve them. One example is providing enough energy to meet the growing world population, which the United Nations projects will reach 9.8 billion by 2050. In one vignette, former ORNL Director Thom Mason discusses the promise and limitations of renewable energy, nuclear power, and fusion power. “All three of those different potential energy sources for the future of humanity are elements of the research and development that goes on in the DOE [Department of Energy] labs today, including at Oak Ridge,” he explains.

ORNL supercomputers such as Summit, unveiled in 2018, contribute to this research mission. As Nuclear Engineer Kevin Clarno details, supercomputers are used to make nuclear reactors function more safely and effectively.



**ORNL is home to many leading scientific and research innovations.**

“We’re able to create computer models that predict what is happening in a plant today,” Clarno explains. “Understanding, in very high detail, what is happening, where is it happening. So that they’re operating safer, that they can increase the power they produce, without impacting the safety of the plants or the public at all.”

Supercomputer calculations are used in surprising ways. Gordon Fee, former manager of the Y-12 plant, describes how Oak Ridge’s supercomputers designed skirts that improve the fuel efficiency of semi-trucks. “When you see an 18-wheeler go by you, look under the trailer, and you’ll see a skirt that hangs between the wheels,” Fee says. “The fuel efficiency is raised somewhere between 2–3%. When you multiply that by the number of trucks on the road, you’re talking about a billion dollars’ worth of savings in fuel.”

“This symbiotic partnership between AHF and the East Tennessee IEEE Section has resulted in a resource for all. It wouldn’t be of the quality that it is without each other,” adds Austin Albright, the current chair of the IEEE East Tennessee Section. “People who take advantage of the ‘Ranger in Your Pocket’ resources will come away with a greater and clearer understanding of the world changing technological innovations that took place in our former secret city and continue at the facilities born of the Manhattan Project to this day. IEEE is glad to show our commitment to remembering the technological innovations of the past as we actively work on the innovations of tomorrow.”

## Donor-Funded Intern Makes History

The 2019 Elizabeth & Emerson Pugh Young Scholar in Residence at the IEEE History Center, Dr. Francesco Gerali, worked for eight weeks at the IEEE History Center, thanks to funding from the Pughs. Gerali hails from Italy, where he received his education, including a Ph.D. degree in the history of science and technology. He also holds a master's degree in library and information science from the University of Oklahoma, Norman. He has worked or studied in Italy, Australia, and Mexico as well as in Norman, Oklahoma and Philadelphia in the United States. "Elizabeth and I are impressed by the depth and breadth of his training and experience," says Emerson Pugh. "The fact that he grew up in a European country is consistent with the fact that more IEEE Members now live outside rather than inside the United States."

Gerali's research interest has been in the history of the fossil fuel industry. Recently, his focus has expanded to under-



***Gerali's "Scanning the Past" articles on electrical and electronic technologies for petroleum exploration will be published in Proceedings of IEEE in early 2020.***

standing the power and energy business in a broader context, bringing him increasingly in contact with IEEE fields of interest. The IEEE History Center was the ideal venue for him to pursue this professional growth. Watch for Gerali's "Scanning the Past" articles on electrical and electronic technologies for petroleum exploration to be published in *Proceedings of IEEE* in early 2020.

This internship, made possible by the IEEE Life Member Fund of the IEEE Foundation, for more than 20 years has provided young scholars of the history of technology with valuable research experience and an opportunity to work with the History Center staff on a variety of projects. Since 2016, the internship has been supported through the gener-

osity of 1989 IEEE President Emerson Pugh and Betsy Pugh. You can support the IEEE History Center's projects at <http://bit.ly/SupportIEEEHistoryCenter>.

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## Pre-University Workshop Tour and Competition

The Pre-University Workshop Tour and Competition (PWTC) was a project presented by volunteers from the IEEE Córdoba Subsection and approved by the IEEE Foundation. The main objective of the project was to promote learning in science, technology, engineering, and mathematics (STEM) disciplines in pre-university education to motivate students toward a career in STEM fields. The event included visiting schools and presenting technology-oriented topics (including hands-on activities) presented by IEEE volunteers to pre-university teachers and students. More than 50 IEEE volunteers from the Córdoba Subsection and Students Branches in the Argentina Section participated in developing the activities.

The project was divided into two parts. During the first segment, 24 schools were involved, including 58 teachers and 742 pre-university students. A focus was placed on hands-on activities, using lesson plans provided by [tryengineering.org](http://tryengineering.org), where students and teachers used their imagination to think, develop, create, and solve the problems using recyclable material provided by IEEE volunteers. Before working with the material to solve the problem presented, students were required to come up with a solution on paper.

Following the recommendations from the teachers involved, the second part of the event included activities with a strong relationship to programming and electronics. For this reason, Arduino and Snap Circuits were added to the activities offered to the schools. Fifteen schools were visited, with 49 teachers and more than 1,115 students trained,



***Hands-on activities, such as Snap Circuits, were an essential part of the PWTC program.***

in 17 visits made by IEEE volunteers in the Argentina Section. The final activity included the participation of IEEE volunteers in the Córdoba Science Fair (province level), where the "PWTC Award" was delivered to the best projects. It was a great experience to volunteers involved.

Thank you to the IEEE Foundation staff, IEEE Life Members Fund, volunteers from the Córdoba Subsection and Argentina Section, and all of the Student Branches involved, as well as the administrations and teachers from the schools we visited, for their strong support.

Augusto Herrera

# Becoming a Life Member Affinity Group Chair

A Life Member Affinity Group (LMAG) chair is the lead volunteer for an IEEE Section that has an LMAG. The chair sets the tone and is responsible for ensuring that the group is engaging members by conducting informative activities and events that meet the needs of its members.

If you are currently an LMAG chair or are thinking about becoming one, the IEEE Center for Leadership Excellence (CLE) can help you with the necessary preparation to be successful. The website (<https://iee-elearning.org/CLE/>) includes a specific action plan that lists the exact courses to take. Once you are at

the website, scroll down until you see the “Volunteer” icon. Click on it, and it will bring you to a page that includes “View Role Descriptions” and “View Action Plans.” Continue until you see the action plan for “Affinity Group Chairs.” Click on the icon and launch the suggested courses.

If you belong to a Section that does not have an LMAG and are interested in becoming a chair of a group, contact your LM Region coordinator. You can find the list of current coordinators at [www.ieee.org/lifemembers](http://www.ieee.org/lifemembers).

Rosann Marosy

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## Leaving a Legacy

People care. They care about the underprivileged, providing education, and advancing technology. They care about preserving history and celebrating culture. It truly is remarkable.

Every year, millions of people make charitable gifts to organizations in whose missions they believe. Most gifts are made in cash, securities, or some other liquid vehicle. Unfortunately, those in a position to give don't always consider the variety of options available to them.

Time and effort spent planning today can ensure that your wishes are followed tomorrow. They can instill confidence that your estate will be directed as appropriate and provide peace of mind to those you love.

Many donors in these situations have an asset that they don't normally consider when they think philanthropically—life insurance. In today's society, life insurance has become increasingly prevalent. As such, donors who own policies would be wise to consider life insurance as an effective way of providing support to people and causes that they hold dear.

Making a gift of a life insurance policy can often significantly reduce a prospective donor's taxable estate, which can result in substantial tax savings depending upon the donor's income and potential tax liability. Gifting a policy can provide an immediate tax deduction of the fair market value of the donor's policy. This can result in quite significant deductions, depending on the circumstances.

Some important points to remember when considering a gift to a charitable organization, such as the IEEE Life Members (LM) Fund of the IEEE Foundation, include the following:

- The IEEE LM Fund receives the entire amount of the policy upon the death of the insured.



- There is no cap on the size of the policy that may be donated to the IEEE LM Fund, since charitable donations have no ceiling for estate tax purposes.
- In most cases, such a gift does not alter a donor's current investment strategy.
- Such an arrangement may provide a creative way to dispose of a policy that was originally meant to cover a need that may no longer exist.

Naming the IEEE LM Fund of the IEEE Foundation as the beneficiary of your life insurance may be the simplest way to enact this transaction. It is a win-win for both the IEEE and the donor. The IEEE LM Fund receives the proceeds from the policy, and by virtue of the gift, the donor's taxable estate is reduced by the amount of the death benefit. While the IEEE Foundation stands ready to assist donors considering such a transaction, it is always wise to first consult your own insurance agent or estate planner.

# Support Life Member Initiatives Through an IRA Charitable Rollover

On 18 December 2015, U.S. President Barack Obama signed legislation making the Individual Retirement Account (IRA) Charitable Rollover retroactive to 1 January 2015 and permanent going forward. As a result of this legislation, individuals may make direct charitable distributions up to US\$100,000 from their traditional, Roth, or rollover IRAs without including such distributions in their gross income, given they meet the following requirements:

- A donor must be at least 70 1/2 years of age at the time of the transaction.
- The funds must pass directly from the donor's IRA to the IEEE. This provision applies only
  - IRAs and Roth IRAs [SEP or Simple IRAs, 403(b)s, 401(k)s, and pension plans are not eligible]

- Outright gifts (distributions cannot be used to fund life income gifts, such as charitable gift annuities or charitable remainder trusts). The gift may satisfy a donor's IRA required minimum distribution for the year.

Since the amount of the direct charitable distribution can be excluded from the donor's gross income, there is no federal income tax deduction available for such gifts. The IEEE Life Members Fund of the IEEE Foundation qualifies as a 501(c)(3) nonprofit organization (EIN # 23-7310664).

As with any considerations regarding your estate planning, we suggest you consult your attorney and/or tax advisor to make sure this vehicle makes sense given your personal circumstances. Please contact Karen Galuchie (k.galuchie@ieee.org) at the IEEE Foundation Development Office with questions about how to make a gift from your IRA.

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## Publish Your Ethical Dilemma

The IEEE Society on Social Implications of Technology (SSIT) has partnered with the IEEE Life Members Committee (LMC) to publish accounts of members' experiences grappling with ethical dilemmas in professional contexts. If you have an experience that involved navigating an ethical dilemma, consider sharing it with your colleagues through the SSIT or LMC newsletters.

A joint SSIT/LMC committee will vet all initial submissions, and authors will work with the editors of the two

publications to finalize their submissions. Accepted ethical dilemma articles will be published simultaneously in the June and December issues of both newsletters.

Article submissions must be between 300 and 500 words in Word format and include how an ethical situation conflicted the author or a decision maker. The IEEE Legal Department requires that all articles be fully sanitized to protect the privacy of people and organizations.

Please submit manuscripts to Rosann Marosy, at r.marosy@ieee.org.

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tales from the vault

## The Use of Simulation in Nuclear Safety Analysis

After completing my service in the military during the Vietnam War, I took a job as a nuclear safety analyst in Philadelphia in 1973. I was asked to look at the safety of the high-temperature gas reactor (HTGR) planned for the Delaware-Maryland area. Imagine my surprise when I looked at the emergency core cooling system plans and saw water at 72 °F in simple 1-in outer diameter steel tubes coming into the reactor,

which was operating at 1,500 °F. To make matters worse, the thorium fuel was in a graphite matrix, and *when* the pipes blew from thermal stress, superheated steam would spray the graphite, producing hydrogen. That would promptly blow the top off the reactor and, goodbye Philadelphia! Several years later, I saw an article in *Scientific American* touting the virtues of the HTGR; I wrote a letter to the editor reporting my findings.

Luckily, I have not seen a mention of the HTGR since.

Later, I was performing an analysis of a new pressurized water reactor that used a "dry" cooling tower. In a dry tower, instead of cooling water spray, the water is kept sealed in pipes, and fans blow ambient air over the pipe matrix. When performing a simulation, the Nuclear Regulatory Commission required the use of a temperature 20% lower

than the lowest recorded temperature. I did so, and the simulation showed the pipes freezing solid. I reported my findings, and the design engineers suggested turning off the fans and installing baffles. The pipes still froze. If the plant had

been built and a very cold snap hit the area, that would have been it—another Chernobyl.

Down the road, I was let go (as was half the building), and both plants were cancelled. Coincidentally, the entire nuclear industry went into a

downward spiral with no new U.S. orders for years thereafter. I later found safer work, designing plant simulation and control systems.

Brian Berenbach, LSM  
Edison, NJ

## Switching It Up

I earned my B.S.E.E. degree in power engineering at the University of Arkansas in 1961 but couldn't graduate until 1962 because my Army Reserve unit was called up due to the newly built Berlin wall. I had a job waiting for me with the Bureau of Reclamation's Chief Engineers Office in Denver, which they held open for my return. They were involved in developing the massive Colorado River Storage Project and desperately in need of engineers with my qualifications. I moved out in 1962, and the first year consisted of a rotation program where I spent three months each in substations and switchyards, power plants, controls, and construction at Flaming Gorge Power plant in northern Utah.

Upon returning to Denver, I was assigned to S&S, where I designed minor modifications to existing facilities for the first year or so. Apparently, I was better than average, as I was selected to design the first high-altitude (more than 7,000 ft) extra-high-voltage (EHV) (345-kV) substation in the United States. I found a few research notes from

Westinghouse and Colorado Public Service Company's experimental substation at the top of the Rockies but that was the extent of my assistance. I checked out the latest manufacturer's offerings of high-altitude EHV circuit breakers and switches, which were just starting to become available. This was a very exciting and challenging time. I don't know that I ever enjoyed a job more.

Following the successful completion of that project, I was moved up to senior design engineer and given the job of replacing another engineer, with several more years of experience, to design the 230-kV replacement switchyard at Grand Coulee Dam, where there were two power plants, one on each side of the Columbia River with an associated 230-kV switchyard and transmission line terminals for nine generators each (totaling 1,800 MW). The plan was to remove the right switchyard and replace it with an extended forebay for the third power plant addition of 3,600-MW capacity. This required that both existing left and right 230-kV switchyards be combined into a con-

solidated 230-kV switchyard on the left abutment, which would replace the existing 230-kV left switchyard.

The plan called for simultaneous construction of the new 230-kV consolidated switchyard in the location of the existing 230-kV left switchyard while moving the existing 230-kV lines from the two existing power plants and combining them with the 230-kV switching facilities in the new 230-kV left switchyard. This had to be accomplished three lines at a time over a nine-month period and must be completed on schedule, without outages, otherwise the power situation of the entire West Coast could be compromised.

I take great pride that this project was accomplished on time, within 10% of budget. Finally, I designed the 500-kV Third Power plant switchyard. This was among the first 500-kV switching facilities in the country and involved 500-kV oil-filled cables from the Third Power plant through the dam and an abutment tunnel. I couldn't have asked for a more fulfilling first five years.

Clarence Allen Bolin, LSM  
Boise, ID

## Point-of-Sale Automation

Back in 1975, one of my first jobs was working for the chief engineer at a firm that was focusing on a point-of-sale automation system for a clothing retailer. The PDP11 would dial each retail store every night and command the cash register to replay a tape of the day's transactions. The

cash register needed a 200-ms pulse on secondary request to send before it did this (nobody thought about security back then, encryption even less so).

The PDP 11 programmers said they could not program a delay with the required accuracy. The chief engineer asked me to design a card that

would plug into the backplane, intercept the signal between the serial interface and modem, and create the pulse in hardware when the programmer triggered it.

I should mention my education was mostly oriented toward digital electronics, as I had started out as a field engineer on Univacs. In addition

to the necessary RS232 level conversion, my design had a crystal oscillator driving a change of decade counter and some logic to pick off the correct output combination for 200 ms.

I proudly showed my design to the chief engineer, and he shook his head, took a pad of paper, and told me to build the circuit that he quickly drew. It had a resistor, a capacitor,

and a Schmitt trigger in addition to the RS232 level converters.

Nigel Johnson, Member  
Toronto, Ontario, Canada

## The Reluctant Captain

In the 1960s, Sanders Associates developed a “stealth” radar for the U.S. Navy. It used biphasic modulation by a Barker code, multiplied by a maximal length shift register (MLSR) code, multiplied by another MLSR code. It had a chip rate of 100 MHz, giving it a range resolution of 5 ft. That wasn’t something we wanted, just an unavoidable by-product. The signal processing load was immense, of course, but by a combination of analog and digital processing, we managed to achieve 2 gigaflops. That was only enough for a narrow annulus in range but sufficed for a proof-of-concept. The radar was so complicated that the customer’s engineers could never quite remember from one meeting to the next how it worked, so we would have to explain it all over again each time.

When development was complete, we installed the whole thing, comprising about eight relay racks, into a 20-ft trailer with an SPS-10 antenna mounted on the roof, for sea trials. From the moment the trailer was lashed to the deck of the destroyer USS *Gyatt*, the

ship’s officers displayed a lively interest in the radar and lined up for tours of it (the trailer could accommodate only a few at a time). The concept of a low-probability-of-intercept radar was new and exciting to them.

Through the two-week test period, there was always a bunch of officers observing, in addition to those conducting the test—all except the captain; he showed no interest whatsoever. One might even wonder if there was a faint breath of hostility. And who could blame him? His ship was a testbed, and he had to suffer the indignity of continually experiencing mysterious equipment welded or screwed to his deck, superstructure, or mast and having to steam intricate courses in conjunction with other ships and aircraft, for purposes which were never fully explained to him.

Our radar was tested against many types of vessels and aircraft. One day, when the target was a “small boat,” the project engineer, who was manning the radar indicator, noticed a tiny speck detach itself from the blip

that was the boat. It remained visible for only a few scans and then disappeared. He asked the radio operator, standing next to him and wearing a headset, to ask the boat if they had just dropped something overboard; yes, and it was a box of trash from lunch.

That was pretty exciting, as the range was considerable. Speculation abounded. Could some tinfoil have made an accidental corner reflector? Could a fruit juice can have been an accidental cavity resonator tuned to our frequency? Whatever it was, the observers were impressed. That evening in the officers’ mess, the detection of a box of trash was a major subject of conversation. The next morning, bright and early, guess who was standing at the foot of the steps, ready for his first tour of the radar? That’s right, the skipper. And he came to watch part of the testing every day thereafter.

Fred Cann, LSM  
Brookfield, NH

## A New Antenna for Two Bags of Sugar

I joined the U.S. Navy in 1950 and, after boot camp, was sent to electronics school on Treasure Island in San Francisco. The Korean War was in “full swing” when I graduated, and I was sent to Japan to my assigned ship, the USS *Condor* AMS 5. It was a World War II minesweeper put into duty along the coast of North Korea to prepare the harbors and possible assault beaches for potential landing sites.

My wartime duty was standing quartermaster watches and occasionally ducking from enemy fire; my electronics responsibility consisted of mainly replacing vacuum tubes or cleaning out a junction box full of gunk from the sea air. After a year, I was rotated back to the United States to another minesweeper in Long Beach Navy Harbor. Across the harbor, I heard of an opportunity to get a billet on a tank landing ship (which was being reconfigured as

a minesweep tender), get back into action in Korea, and expand my skills. After a few months, I was promoted to electronic technician petty officer 3rd class. We soon left port on our shakedown and headed for Honolulu for supplies.

We were out only a day or so when the radio room started complaining that the transmit range on the low-frequency (LF) transmitter was very limited. This was critical as

it was used primarily for long-wave contact to other ships or land stations. The antenna looked like it had been replaced during the refurbishment. I tried my hand at tuning the LF transmitter, which involved varying the loading capacitance. I turned the knob, but it would arc-over, just like the radiomen had reported.

We had a library on the ship, and it contained a book about the design of long-wave antennas. I quickly determined the problem: the antenna was integral to the output circuit. Due to its configuration, in the shape of a “T,” the antenna appeared as a “stub,” not long enough to act as an inductor to

the output. I reasoned that an antenna of about the same length taking up similar space could be constructed in an “L” shape, making it look longer to the transmitter output design.

I needed about 200 ft of phosphor/bronze wire rope. The U.S. Naval base at Honolulu had a repair yard, so off I went. They had what I needed, but the 1st class petty officer said it would have to come through my ship’s supply officer and would take several weeks. I told him it was urgent due to our inability to raise another ship and asked if there was anything we could swap. With a twinkle in his eye, he asked if I could find two bags of sugar.

Great, now all I had to do was sweet-talk the cook out of the sugar.

I went to our cook, whom I had known for only a couple of months, and cried on his shoulder. We were in the great Pacific Ocean with no way to communicate if we needed help. He was funny, but heard my plea and gave me the sugar for the well-being of all on board the ship. I got the wire and strung the cable, and the radio gang was so happy they were transmitting while I was still finishing tightening the bolts to the insulators.

David S. Cochran, LM  
Medford, OR

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## The Saturn-Apollo Lunar Landing Program

Successfully getting to the moon before the end of the 1960s involved a lot of critical design choices and what, to me, were “essential moments.” One such moment involved a decisive decision, seconds before launch of the AS-203 mission. This decision violated a primary launch rule but was one subtle, big moment on the way to achieving President John F. Kennedy’s audacious goal.

During college, I had the privilege of working in the Cooperative Education Program with NASA during the Mercury and Gemini programs. Most of my work tours were with the Biomedical Instrumentation group in Hanger S at Cape Canaveral, Florida. Upon graduating from college with a B.S.E.E. degree in April 1966, I joined the Douglas Aircraft Company (which later merged with McDonnell to form McDonnell Douglas Astronautics Company) as an instrumentation engineer on the SIVB stage of the Saturn IB (SIB) rocket. The SIVB was the second stage of the SIB rocket and the third stage of the Saturn V moon rocket.

In getting to the moon, the initial burn of the SIVB provided the final impulse to inject the Command Service Module and Lunar Module into an Earth parking orbit. During the second

or third revolution, the SIVB stage reignited and burned for some six-plus minutes to inject the command and service module/lunar module into a translunar trajectory. Understanding the parameters for ensuring full settling and degassing of liquid hydrogen before restarting the SIVB rocket engine was vital for success.

The SIB rocket served as the test base for the Apollo program components and several key developments in rocketry to get to the moon. The SIVB’s liquid hydrogen/liquid oxygen propulsion system was one of these key innovations. Early tests with liquid hydrogen/liquid oxygen engines demonstrated the need for extreme attention to the behavior of liquid hydrogen under zero gravity. The liquid hydrogen broke up into a lot of sticky blobs. These blobs had to coalesce into a bubble-free liquid prior to restarting the rocket engine. Not achieving this state would result in cavitation, turbine overspeed, and likely destruction of the rocket stage.

In July 1966, just two months into the job, I was monitoring the SIVB stage instrumentation signals at a rack of equipment in the back of the Pad 34 blockhouse. The countdown was proceeding for the launch of

Apollo Saturn mission 203. The goals of the mission included checking out Apollo spacecraft activities needed for the lunar mission and the performance of the liquid hydrogen settling and outgassing process necessary for successfully restarting the SIVB rocket engine. Two cameras at the top of the liquid hydrogen tank were to monitor the behavior of the liquid hydrogen during the burn of an auxiliary hypergolic propellant thruster used to settle the liquid into a bubble-free state.

To ensure mission success, AS-203 had a strict launch rule—both cameras must be working or the launch could not proceed. Sure enough, in the last moments of the countdown, one of the cameras failed. The test conductor called a hold. He noted the camera rule and was getting ready to scrub the launch when a booming, authoritative voice was transmitted over the communications network: “We will launch the rocket!” It was Wernher von Braun. It was an essential moment that kept the lunar landing goal on track, and it remains fresh in my mind to this day.

Pete Daniher, LSM  
Tampa, FL

## Flying Spot Colors

When I scan and print a color document, I often recall a project at RCA in Camden, New Jersey, in 1954—before the Institute of Radio Engineers became the IEEE. I was an “engineering specialized trainee” assigned to work under the direction of John Rydz on a project to develop a system to scan artwork, process the signals, and end up producing a set of color separation negatives for a printing press.

To make an offset printing plate in those days, the artwork was photographed three times, using a filter for each color, resulting in three gray-scale images of the red, green, and blue (RGB) components of the original image. These images were then inverted, resulting in images for the cyan, magenta, and yellow color inks used in printing presses. The result should be a reasonable reproduction of the original but, in practice, that was not the case. A test run on the printing press might reveal, for instance, that the blue sky is too red. Therefore, a technician would then

use a chemical process to etch the metal printing plate in an attempt to correct the color. This was done for each plate, if necessary.

Mr. Rydz explained that the scanner under development used a cathode ray tube set up as a “flying spot scanner.” Signals from the scanner’s RGB color separation system were to be applied to a computer, which would correct the signals to specify the correct amount of cyan, yellow, and magenta information—after creating information for a plate using black ink instead of the combination of cyan, yellow, and magenta inks to create black. This avoids overlaying three colors. The ink percentages thus calculated for each color would result in a print that faithfully reproduces the scanned original (patent #2,885,463, 5 May 1959, assigned to RCA).

One of my tasks was to develop a circuit for linear division of RGB signals as they were processed by the color correction computer that changed the RGB information into cyan, yellow, magenta, and black ink require-

ments for printing. During the time I was a trainee with the project, colored artwork to be printed in the *Saturday Evening Post* was scanned in a small, dark room full of racks of electronic controls and computing circuits, a large cathode-ray tube flying spot scanner, and a large frame to hold four photographic plates to record the corrected color information. That system produced color-corrected images for each of the four colors. (Today the 12-in x 18-in scanner on my desk does all that and more!)

I delivered those images to the *Saturday Evening Post* printing facility in Philadelphia. Sure enough, the plates made from the color correction scanner/computer images faithfully reproduced the original art. The artwork was printed as the centerfold in an issue of the *Post*. The centerfold from that issue is buried somewhere in my files and, if I find it, it’s going to be framed alongside this article.

Melvin D. Ely, LM  
San Diego, CA

## A Self-Test for Nuclear Magnetic Resonance Instruments

Between 1971 and 1973, I developed an automated system for radio transceiver testing. This system consisted of sources (signal generators) and measurement instruments, such as frequency counters and power meters, all under the control of a digital computer. If the sources were connected directly to the measurement instruments, the system could test itself by varying and measuring amplitudes, frequencies, and modulations. The self-test concept has been widely applied to computers, peripheral devices, cell phones, and the like.

In 1990, after developing many automated electronic and physical instrumentation systems, I interviewed at a manufacturer of nuclear magnetic resonance (NMR) instruments. These consisted of signal

sources and receivers, controlled by a digital computer, that were used to identify the composition of a chemical sample immersed in a magnetic field. It had been recognized that, in principle, purely electronic measurements could be used to verify the operation of the electronic portion of the instrument, without depending on the chemical sample or magnetic field. This was not trivial because the magnets used superconducting materials that cost hundreds of thousands—or even millions—of dollars. But efforts to apply self-test techniques to the electronics, separate from the magnets, had not been successful.

At the block diagram level, these instruments were not unlike other systems with which I was familiar. However, the control of such self-test

operations could only be accomplished in an NMR software environment that had been developed by chemists to analyze chemical samples and which was poorly suited for self-test purposes. I felt that I could circumvent these difficulties, but that I would need time and support to demonstrate a proof-of-concept that would test only a small portion of the instrument. I was able to get that support and develop a comprehensive automated self test for NMR instruments. As these instruments became more complex, the self test also became more comprehensive. My effort ended 13 years later when the NMR operation was sold, and I retired at the age of 67.

Robert Gilchrist Huenemann, LM  
Hollister, CA

## Stitching Together North America

The blackout of 1965 impacted most of the northeastern United States and part of Ontario, Canada. Over 30 million people lost power. At that time, I was a senior at Rensselaer Polytechnic Institute (RPI) in Troy, New York, and it motivated me to join the power engineering program offered by Prof. Eric T.B. Gross, the dean of RPI's power school. I earned my B.S.E.E. degree in 1966 and my M.S.E.E. degree in 1967.

I then joined the Electric Utility Systems Engineering Department (EUSED) of the General Electric Company (GE) in Schenectady, New York, where analyses of the 1965 blackout, and the development of recommendations for avoiding such events in the future, were underway. EUSED was GE's power consulting group, but we also did studies for electric utilities. Some of them (such as load flow and transient stability, involving the modeling of thousands of busses and hundreds of generators) required the use of advanced software and large-scale digital computers, which many power companies did not have. Thus, they contracted with GE, and engineers like me would do the work.

EUSED had world-class experts to provide guidance, such as Charles Concordia (recipient of the 1999 IEEE Medal of Honor "for outstanding contri-

butions in the area of Power Systems Dynamics, which resulted in substantial improvements in the planning, operation, and security of extended power systems"). As a "trainee" I was fortunate to assist with a groundbreaking effort where a digital model of the entire North American system was constructed. Working from individual utility data sets, we stitched them together electrically. Analogous to what tailors do when making a piece of clothing, we had to decide how much of an overlap between systems would result in a smooth seam. That is, the model needed to converge to a solution, and it must yield useful results.

We ripped apart the tailored power garment and tried another fitting numerous times, and the effort took approximately a year, as back then the North American system was not completely interconnected. Although there were some transmission ties, much of it was not operated as a combined system with normally closed breakers between areas and/or coordinated generator operation. As a result, when the data was force-fit to model overlap, the result sometimes was computational nonconvergence, or electrical instability.

However, some glitches were beneficial because they showed us where there might be good locations for

strengthening the grid (for example, via the formation of power pools that would result in lowering the total cost of delivered power to consumers or identification of where dc transmission lines were better than ac connections). It is heartening to know that, even after I left GE in 1990 to form my own independent consulting firm, some aspects of these efforts still endured as guidance for the work continuing there and in the industry as a whole.

My drafting skills were also tested. I had to produce by hand, on a single sheet, a one-line diagram of the entire high-voltage network. However, when it eventually could be drawn using software, much to my chagrin, GE was ready to throw out my 6-ft X 9-ft masterpiece, but I was able to save it in my basement at home until recently, when I donated it to the archives at Schenectady's Museum of Innovation and Science. The museum has a large collection of GE historical artifacts including much relating to the giants of the power industry such as Thomas Edison and Charles Steinmetz, who made GE's Schenectady "works" one of the wonders of the modern world during its heyday.

Richard P. Felak, L&M  
Schenectady, NY

## Dumb-Gob-Proof

In the mid-1950s, I was a member of a team of engineers and technicians at a small company in central Connecticut. We had a contract with the U.S. Navy to develop a shipborne gyro-stabilized receiver/tracker for meteorological radiosondes.

The day arrived for the first factory-floor integration of above-deck equipment with the control console. An emissary was dispatched to the chief engineer, as he had requested. He spent a few moments admiring the 6-ft-diameter parabolic reflector on its triple-gimballed mount, the gyroscopic "stable platform," the electronics cabinet/work-

bench (all in gleaming "battleship gray"), and the mass of interconnecting cables. There was a draft copy of the instruction manual laid out, but he pushed it aside saying, "I'll pretend I'm a dumb gob who won't be bothered and probably is incapable of reading it."

He reached across and rotated the main control knob from "lock" to "stow." Motors whirred as pins were retracted from the gimbals. The next position, "manual," enabled joystick manipulation, and gimbals began to move. Suddenly, the "dumb gob" said, "Uh-oh, it's coffee break time. I'm going to shut down." He turned the knob two

steps back, evoking a chorus of "No," "Wait," and "You can't!" It was too late. There was a sickening crunch as gimbal frames bent, gear teeth sheared, and the machine came to a shuddering halt.

The boss looked around at his team, perfectly dead-pan. Without a word, he swiveled around, got to his feet, and walked back to his office. Our criterion of acceptability had just been raised from "fool-proof," through "darn-fool-proof," and all the way to "dumb-gob-proof."

Daniel P. Petersen, L&M  
Las Cruces, NM

## All About Clutter

In the mid-1970s, the Cold War was in progress, with much rattling of swords and the proliferation of intercontinental missiles. Into this atmosphere was born the idea of intercepting enemy warheads beyond or in the atmosphere, which resulted in the Safeguard Missile Defense System.

Safeguard consisted of two radar systems, the first being the long-range Perimeter Access Radar (PAR) and the Missile Support Radar (MSR), and the second was two intercept missiles, the SPARTAN for intercepts outside the Earth's atmosphere and the SPRINT for intercepts inside the atmosphere. The concept was to detect and intercept using the SPARTAN missile at long range but, if that failed, use the faster SPRINT to intercept before warhead impact.

I had the good fortune of working as a support programmer in the MSR radar interface, setting up the radar pulse patterns as required by the mission parameters. While on assignment at the SAFEGUARD test

facility in the Marshall Islands, there was one problem that continued to plague intercept testing, especially with the SPRINT missile. There is a phenomenon, called *ground clutter*, that could mask both intercept missiles and target vehicles at low altitudes. There was a similar problem in distinguishing target vehicles and launch junk outside the atmosphere, where the warhead, shrouds, covers, etc. all moved at the missile velocity. That problem was relieved once the warhead entered the atmosphere, as the other "junk" immediately slowed to a much slower velocity and the warhead "popped" into view. What was needed was some type of moving target indicator (MTI), a technology that had been around for a number of years in long-range radar search systems but with targets moving at a much slower speed. The trick for SAFEGUARD was to figure out an MTI process for a target with a terminal velocity approaching 16,000 mi/h.

The MSR was built by Raytheon and was a phased array radar, capable of

directing the radar beam and pulse repetition rate (PRF) under software control. Based on my experience, both as a radar field engineer and test system programmer, I reasoned that we should be able to implement the equivalent of an MTI in the operating software. I researched the radar control algorithms and the nature of our targets. I wrote a moderately complex patch for the radar control system to allow changes in PRF, allowing shorter times between pulses. The idea was to sense the target at more frequent intervals than normal, thus "seeing" what targets were moving and which were not—relatively speaking. The patch was tested on a system simulator exercise and appeared to function as desired.

The proof came when the patch was installed on a live target test and passed with flying colors. It certainly felt good after that when the Control Center said, "Please bring the clutter patch to the Control Center."

Raymond Floyd, LSM  
Cody, WY

## Pitfalls

In 1955, I had a new B.S.E.E. degree from the Milwaukee School of Engineering, and, although I graduated near the top of my class, my opportunities were limited because I had two years to go before I could become a U.S. citizen. While most of my classmates ended up in California, I had only two offers, one being work in the Research Division of NCR (at the time it was known as the National Cash Register Co.) in Dayton, Ohio, which was the position I accepted.

It was an interesting time; everyone was searching for ways to do computer logic, but that is a story for another time. Fluorescence and fluorescent materials were some of the "new" discoveries with which we

worked, and they also seemed to have captured popular imagination. It was then when the U.S. Postal Service issued a stamp that fluoresced in the far ultraviolet with the hope that the technique might contribute to making mail sorting more efficient. It was a long time before the Intelligent Mail barcode.

One day, while working in the lab, I discovered that my newly laundered dress shirt had my name and large numerals visible under our "black light" sources. It was obviously convenient for the laundries. We thought it was amusing, but apparently, not everyone who discovered it felt that way. A few weeks later, the fluorescent writing was smaller and tended to be hidden by a tie, which was then

de rigueur for professionals. Some months later, there was no longer any fluorescent printing at all on the shirts.

Meanwhile, some fancy cocktail lounges of the "Below the Sea" type used black light with beautiful, colorful fluorescent artwork on the walls providing the dim illumination. The disappointing discovery then was that while natural teeth (as well as fingernails) fluoresce under ultraviolet light, false teeth and implants do not, causing the illusion of missing teeth, which was disappointing to a person who was glamorous in normal daylight. Ah, the wonders of science and unexpected outcomes.

Hans Schroeder, LSM  
Milwaukee, WI

## A Contamination-Monitoring System for High-Voltage Insulators

During Christmas 1991, a record number of sea salt contamination outages occurred on Florida Power & Light's transmission system, spoiling many holiday dinners across the company's then-4.5 million customers. An investigation showed that onshore winds between October and December deposited surf-generated salt onto transmission line insulators on Florida's Atlantic coast. The buildup of salt was unimpeded due to insufficient natural rain washing. Low humidity during this period prevented nightly condensation on the salty insulators that would have produced visible surface arcing and sizzling sounds. These "clues" of salt build-up were not active in this period. Outages occur when heavy dew wets tops and bottoms of the salty insulators, which causes them to flashover and trip the entire line. Heavy dews occurred 20-29 December when it finally rained, rinsing off the salt.

One of the actions taken was to initiate a research and development project to monitor salt build-up and provide early warning. We retained Dr. C.N.

Richards of Atmospheric Physics, Inc., who had researched salt contamination behavior for a California coastal utility.

Three concepts were evaluated for sensing buildup of salt on the insulators:

1. Monitoring leakage currents on insulator surfaces: Leakage current is a function of the amount of salt plus the amount of water on the surface. It can be large for a little salt and a lot of water or a lot of salt and a little water. Leakage current can't distinguish which is the case.
2. Monitoring weather parameters: Weather parameters associated with salt buildup seemed like a promising concept to investigate, however research into the amount of wet salt particles produced from surf did not reveal any ways to quantify the amount of salt on the wind.
3. Creating a sensor that could quantitatively indicate the buildup of salt: Dr. Richards, an atmospheric physicist, devised a capacitance-based sensor to measure the thickness of water condensed on a surface. Knowing that the amount of water thus condensed is a function of the dissolved

salt content (Raoult's law), he was able to calibrate the sensor to reveal the amount of salt on its surface.

Using that sensor along with monitoring weather conditions, a field deployable remote contamination monitor (RCM) was developed. Three prototypes were installed along Florida's east coast and evaluated for a year. A patent was applied for and eventually granted—U.S. Patent 5,764,065.

In the mid-1990s, the prototypes were replaced with nine commercial versions of the RCM installed in coastal Florida locations from Daytona Beach to Homestead. The units sent data via cell service each morning to software that analyzed it and reported the buildup, or reduction if it rained, on a scale of one to 10 for each of the areas they covered via the company intranet.

A practical technological solution to a serious electrical system operational problem had been successfully implemented. One of nature's intractable assaults on one of man's most important infrastructures had been counteracted.

Joseph D. Renowden, LSM  
Jupiter, FL

## A Steamy Transition

I am writing in rebuttal to an article submitted by Ed Annick, "Blowing Off Steam," that appeared in the June 2019 issue of *IEEE Life Members Newsletter*. I would like to present the facts as to why the U.S. Navy converted all shipborne catapults from hydraulic oil to steam driven of which Mr. Annick is not aware.

To start, my older brother, Allen Zang, was a graduate of Kings Point Maritime Academy with a B.S. degree in marine transportation, and he was granted an ensign's commission in the U.S. Naval Reserve. He was also licensed as a third assistant engineer for ships machinery by the U.S. Maritime Commission. After graduating from Kings Point, Allen sailed for a year in the Merchant Marine to earn money to

attend the Massachusetts Institute of Technology (MIT) to study marine and naval architecture. He was admitted to MIT as an advanced student, completing the course in two years and graduating with a B.S. degree. Upon graduation, Allen joined the American Bureau of Shipping, performing stress analysis on ship structures.

With the possibility of being drafted into the U.S. Army, Allen went on active duty in the U.S. Navy. He was initially assigned to the U.S. Naval Ship Yard in Boston because of his extensive engineering background and knowledge of ships. While on duty there, a fire broke out on an aircraft carrier undergoing repairs. He told me that one of his classmates from Kings Point died as a result of the fire, as

well as some of the naval personnel. Allen was on the Board of Inquiry to determine the cause of the fire. The board determined that one of the hydraulic oil lines to the catapult sprung a pinhole leak that was ignited by a nearby welder's torch. The Board of Inquiry recommended that all hydraulic lines in the U.S. Navy be steam driven, as high-pressure steam is readily available for driving the propulsion machinery for the ship. This is the reason that all catapults in the U.S. Navy are steam driven. These are the facts related to me by my older brother, who was there at the time of the aforementioned events.

George R. Zang, LSM  
Westbury, NY

## A Powerful Algorithm for Numerical Problem Solving

After earning my B.E.E. degree at the City College of New York in 1961, I went to work for Bendix Aviation in Teterboro, New Jersey, as a project engineer on the Pershing missile guidance system. In 1963, I was hired by the Columbia University Electronic Research Laboratory, located in Harlem, New York, to work on classified missile-defense-related matters. After I earned my doctorate from Columbia University in 1969, I decided that what I really wanted to do was to be a professor, teach, and do my own (unclassified) research. I joined the faculty at Yale University but soon realized that engineering there was not taken very seriously (with the active faculty having left to start a new engineering department at the University of California, Santa Barbara), and I decamped for Rensselaer Polytechnic Institute (RPI) in Troy, New York.

At RPI, I met some very fine colleagues, not only in the Engineering Department but also in the Math Department. I became interested in probability and random phenomena and with my colleague John Woods, in the electrical engineering department, we wrote some well-received

textbooks in this area. I was happy to read that our books were used in some of the highest-ranking universities in the United States.

At that time, some of my research was supported by senior engineer Heywood Webb of the Rome Air Development Center at Griffiss Air Force Base. It was through Heywood that I met Dan Youla from Brooklyn Polytech, who was also funded by Webb. Dan was the smartest guy I ever met, and he introduced me to an algorithm he had found in the Russian technical literature. Dan was one of those few, non-Pentagon, nongovernment people, who actually read what the Russians were doing and had the brains to follow their most complex papers in mathematics and engineering.

For lack of a better name, the algorithm was initially called *Projections Onto Convex Sets (POCS)*. Years later, when my former student Yongyi Yang and I wrote a book about POCS and its extensions and applications, we called it *Vector Space Projections* (Wiley: New York, 1998). Yongyi, now a full professor at the Illinois Institute of Technology in Chicago, has applied vector space projections to a host of practical engineering problems: from

improving low-resolution to high-resolution medical images, designing optimum array antennas, crafting finite-impulse response filters, developing all matters of diffractive optics, and many other applications.

The idea behind POCS is quite simple: think of a Venn diagram with many partially intersecting “circles.” At the center of this Venn diagram is the “solution region”; it is the intersection of all the circles and contains the elements common to all circles. Each circle is a symbolic representation of the set of the elements of prior information about the object you want to restore. For example, suppose you have  $n$  low-resolution satellite images and would like to combine them to form a high-resolution image. Each low-resolution image, in this case, would be an element of one of the circles and serves as a constraint on the solution. When all the constraints are satisfied, we have the solution. The POCS algorithm is iterative; it will always converge to the solution, provided that the solution exists.

Henry Stark, LF  
Delray Beach, FL

## A Frugality Fault

I started my career working at an aerospace company in June 1968. The very first job I was given was to get a batch of switching power supply modules checked out and working. I ensured that the parts agreed with the assembly drawing and parts list and that there were no shorts on the power inputs. I then fired up the first module and...nothing! The module refused to switch, and there was no output. I tried out the next module with the same result...nothing again. I carefully checked the board circuit trace runs

against the electrical schematic and they agreed. I consulted with an analog “weenie,” who looked everything over and said he saw no problems and that the modules were in production and should function.

I went in to work over the weekend to see if I was missing something. In trying different things, I put a large capacitor across a 10-uf capacitor, and the circuit switched and operated perfectly. This made me suspicious. I went back and looked at the revision history of the module. Lo and behold, there was a change made where the

project engineer had replaced an expensive 1-uf capacitor with a cheap 10-uf capacitor to save cost.

There was a reason why the original capacitor was expensive; it was due to a requirement for very low equivalent series resistance in the application. The project engineer apparently never understood the requirements of the part and did not test the change. I wrote an engineering change to put back the original part and completed the check-out of the modules in one day.

Norm Dick, LM  
Fairfield, CT

## Reinventing the Wheel

My research in the late 1970s and early 1980s involved investigations of electrically small antennas and some work on cavity resonators. I became intrigued by the possibility of using superconductivity to improve the performance of these devices (this was just before high-temperature superconductivity was discovered in 1986, which had a great influence on my work); it seemed to me that the efficiency of electrically small antennas could be pushed up dramatically, and there was the possibility of building a “supergain” antenna, which is a somewhat theoretical concept that is known to be limited by losses in the conductors. For cavity resonators, either much higher selectivity could be achieved in a device the same size as one made of ordinary metal or, alternatively, a much smaller cavity could be constructed that would achieve the same level of selectivity.

I was dismayed that industry shied away from low-temperature superconductivity that, while being a bit of a hassle, is really not rocket science to deploy. To break the ice, I took on a master’s degree student to build a copper cavity resonator and have it plated with lead (the simplest low-temperature superconductor), as there was a lead-plating production

line established at Oxford University (This was being used to build cavities for a linear accelerator, but they kindly expressed a willingness to do small jobs for me.)

We tasked our workshop to create a simple axisymmetric re-entrant cavity with a loading stub in the center. It was then taken to Oxford and came back a nice uniform gray color, as expected. My student then brought it to the British national liquid helium facility at the Rutherford–Appleton Laboratory, not far from Oxford. The plan was to “dunk” it in the liquid helium and allow the interior to flood with the liquid, the idea being that this would not introduce significant loss, and the shift in the resonance could be calculated.

Returning from the test, my student was discouraged, as he reported that the lead plating had fallen off and all that was left was a dirty copper surface. Being quite a perfectionist, he was immediately determined to give it another try, and the first step was to clean up the cavity. Having read many papers about the technique of “electropolishing,” in which a kind of reverse electroplating technique is used to smooth off rough surfaces, he declared that he was going to clean and polish the cavity by that method. He placed it in

a bucket of weak sulfuric acid and applied an appropriate dc bias. The next thing I knew, he burst into my office in a state of near shock, declaring that “the lead has reappeared!” He really thought something supernatural was happening.

Fortunately, I had studied a lot of chemistry when I was younger, and the explanation came to me almost immediately: we had reinvented the lead-acid battery. The “dirt” on the copper was not copper oxide but lead dioxide, which looks very similar to copper monoxide. This is exactly what happens in a traditional vehicle battery, in which lead dioxide forms on the anode when it is charged and is reduced to lead as it is discharged. Our error was that we should have used oxygen-free high-conductivity copper. Soon after this, high-temperature superconductivity was discovered, and the idea of using low-temperature materials was abandoned.

I have had some success in my career, but this was a very memorable example of a failure. It is often said that one learns more from mistakes than successes, but unfortunately, it was too late to invent the car battery.

Peter Excell, LSM  
Bradford, U.K.

## Errata

On page 9 of the June 2019 issue of *IEEE Life Members Newsletter*, there was an error in the “Tales from the Vault” article authored by Peter Brooks. The term *thyatron* was inadvertently referred to as “thyration.” We apologize for the error.

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We welcome articles for this newsletter. In particular, we seek articles about projects that are initiated at the Section and Region level by Life Members as well as “Tales from the Vault,” which should focus on novel or interesting technical issues. The suggested length for “Tales from the Vault” submissions is 500 words.

Acronyms should be completely identified once. Reference dates (years) also should be included. Editing, including for length, may occur. If you wish to discuss a story idea, you may contact Craig Causer, managing editor, by e-mail at [lm-newsletter@ieee.org](mailto:lm-newsletter@ieee.org). The deadline to submit an article for possible inclusion in the next issue is 1 April 2020. Please include your Life grade, town, state, country, phone number, member number, and/or an email address with your piece.

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