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IEEE life members newsletter

contents

Elevation Encouragement

Aleksandar Szabo, Chair, Life Members Committee

There are approximately 31,000 IEEE Life Members (LMs) including Life Fellows and Life Senior Members. In January 2017, this number will increase further. A total of 2,929 Members will become IEEE Life Members, effective 1 January 2017. A significant number (two-thirds) of LMs are at the Member grade. I am sure that many of the LMs qualify for the Senior Member grade, and I would like to encourage our LMs to apply for elevation to the Senior Member grade. You will need three references, but if you can find a nominator, you will need only two of those references. Contact your Section, and ask for help. To learn more about elevation to the Senior Member grade, visit www.ieee.org/membership_services/membership/senior/index.html.

IEEE Life Members Committee Chair Aleksandar Szabo

The Life Members Affinity Group (LMAG) Achievement Award was established and assigned for the first time in 2015. In 2016, the award went to the Israel Section Life Members Affinity Group for activities in 2015 recognizing the continued involvement in modern technologies. Congratulations!

The Life Member Fund (LMF) and the IEEE Foundation Fund continue to partner in support of projects that are important to LMs and the IEEE. To learn more about the IEEE Foundation/LMs Grants Program, visit ieeefoundation.org/grants. I urge you to join me in contributing to the LMs Fund as you renew your free IEEE life membership for 2017. Your continued support helps fund many worthy programs. The LM Committee helps to select projects that deserve financial support from the LMF through the IEEE Foundation/LM Grants Program.

If you would like to be engaged and active, get in contact with your local Section, Chapter(s), and LMAGs. If there is not an LMAG in your Section, it would be beneficial to establish one. Many activities can be organized in cooperation with young professionals and students. In Region 8, the Mind the Gap Contest (www.ieeer8.org/category/student-activities/awards-and-contests/sa-contests/mtg/) has been organized by the Student Activities Committee to come up with a project idea that brings younger and older generations together.

Since 2010, five technical tours have been organized by the Life Members Committee: Panama, the United Kingdom, Japan, Canada, and the most recent one in 2015 to Europe (France, Germany, and Switzerland). For several reasons, in November 2015, the Life Member Committee decided to discontinue the IEEE Life Member Technical Tour program. There are some ideas and initiatives to organize technical tours on the Region and Section level. The organizers could be Sections or a group of Sections and their LMAGs.

Our *IEEE Life Members Newsletter* is highly regarded by IEEE LMs. It also goes out to IEEE Members (whose interests are often similar to those of LMs), such as retirees or Members approaching retirement. These Members are welcome in LMAGs. Stories focused on history, local LM activities, and the programs supported by the IEEE LMF are published. The newsletter welcomes articles, categorized as "Tales from the Vault," that share personal stories and involvement with technological achievements and solutions. We are looking for your contributions. Past issues of the newsletter are available on the LMC's website at http://www.ieee.org/lmc.

IEEE

The IEEE History Center's Program REACHes New Jersey High School

Excitement, intrigue, and laughter filled two history classrooms at Manalapan High School in New Jersey on 10 June 2016 when history teachers Brian Sullivan and James Somma introduced the IEEE History Center's first Raising Engineering Awareness through the Conduit of History (REACH) pilot. The complex relationship between navigational technology, its advances, its place in history, and its impact on economics and society in the early modern period are the premise of the first REACH unit, and a major step forward has been taken with this first pilot, the maritime navigation unit. As the REACH program manager, it was wonderful for me to see the program come to life and watch how the students reacted to all the elements that encompass REACH. It was particularly exhilarating to observe students as they grasped the concepts of how the technologies of early maritime navigation affected the relative preeminence of different societies.

A high school student carries a needle in a bowl during the REACH program at Manalapan High School in New Jersey.

Students participate in the classroom during the REACH pilot program.

Former IEEE History Center Senior Historian John Vardalas, now retired, worked with Michelle Lilley, Manalapan High School's social studies supervisor, to create the inquiry unit (lesson plans) for the maritime navigation pilot, including hands-on activities. In addition, Vardalas provided the teachers with background information on the history of the technologies tied to maritime navigation in the early modern period and its relevance to the other social, political, economic, and military changes taking place at that time. Vardalas emphasized the importance of understanding the power of the sea, pointing out that Sir Walter Raleigh proclaimed, at the close of the 16th century, "Hee that commands the sea, commands the trade, and hee that is Lord of trade of the world is Lord of the wealth of the world." Finding one's way across the oceans, however, was far more difficult than navigating on land and the penalty for error was often deadly. The very difficult challenge of navigating across the world's vast and undifferentiated ocean had to be mastered. To command the hostile environment of the sea, advances in science and engineering were essential.

The piloted lesson plan was on the magnetic compass, widely regarded as one of the greatest inventions of all time. It also highlighted Portolan charts, a European invention that enabled the compass to achieve its full potential as a revolution in navigation. The full inquiry unit further explores the evolution of technologies associated with determining latitude and the quest to find longitude, both essential to mastering seafaring navigation. This REACH inquiry unit brings awareness of how mastering the sea was a powerful engine that drove both science and engineering and how maritime navigational engineering and advancements in technology enabled European societies to gain global supremacy. Things then come full circle by showing how today's navigational technologies, such as the Global Positioning System, are based on some of the same concepts developed hundreds of years ago and yet continue to affect society today.

The Manalapan students who participated in the REACH pilot walked away with new knowledge and a richer understanding of the relationships between technology and history. As Veronica Feather, one of the students in the Manalapan pilot, expressed, "If society needs to advance, it will ask something of technology and science, but sometimes science will advance faster than society, and, in turn, that will advance society."

Interested in science and engineering, as well as philosophy, Shreyas Selvaraj, another Manalapan student, explained,

"…there is a whole other side to knowledge and how you can view the world. It's really interesting to find the connections between STEM (science, technology, engineering, and mathematics) and the humanities, and what we have learned here is food for thought."

The IEEE REACH pilot was not only a success with the students but also with the teachers. Lilley proclaims, "My experience with the IEEE has enlightened me to the importance of including scientific processes as a part of history; our progress as humans and societies is contingent upon new ideas becoming a reality. Engaging students in hands-on experiences allowed them to make connections between science and history; reinforcing their understanding of the challenges faced by past generations and providing them with insight to those they may face in their lifetimes."

Other units in the pipeline include Greek triremes, the printing press, and broadcast radio. History Center staff will be presenting and exhibiting REACH at the fall 2016 meetings of the New Jersey Council for the Social Studies, the National Council for the Social Studies, and the Council of State Social Studies Specialists, and the beta version of the website will be ready by the end of the year. In the meantime, you can enjoy a video of the first REACH pilot in the classroom at https://www.youtube.com/watch?v=h0G0U_Ukp7g.

—Kelly McKenna
IEEE REACH Program Manager

Connecting Engineers and Scientists with Public Policy

Washington Internships for Students of Engineering (WISE) has connected engineers and scientists with public policy since 1980. Each year, IEEE selects three outstanding engineering Student Members to participate in the nine-week WISE program in Washington, D.C. Students discover how government officials make decisions on complex technological issues while also learning how engineers and scientists can contribute to the legislative process and regulatory decision making. The WISE Program is ranked as one of the best internship opportunities in the United States by The Princeton Review.

IEEE-USA, IEEE Life Members, and the IEEE Technical Activities Board collectively support IEEE's participation in the annual WISE program. To learn more, please visit www.wise-intern.org.

The three 2016 WISE interns, (from left) Logan DiTullo, Jen Madary, and Michael Crenshaw.

WISE Intern Joins Association of Public and Land-grant Universities

Sarah Rovito, 2007 WISE intern and IEEE Member, recently joined the Association of Public and Land-grant Universities (APLU) as assistant director, research policy. She will focus on the areas of research policy, regulatory policy, and research promotion and advocacy and will be involved with APLU's science, technology, engineering, and mathematics education initiatives. Earlier this year, Rovito received the Best Paper Award at the 2016 IEEE International Systems Conference and graduated with a master's degree from the Technology and Policy Program at the Massachusetts Institute of Technology.

Rovito says that her experience as a WISE intern had a profound impact on her career plans.

"The WISE Program ingrained in me the importance of well-written public policy that is capable of taking technological factors into account," Rovito says. "My summer experience as a WISE intern had a profound impact on my career plans. My eyes were opened to the many ways that scientists and engineers can impact legislation and federal regulation. I am now thrilled to have the opportunity to explore my interest in higher education public policy after working as a systems engineer in the defense industry for several years."

Long Island Section Group Celebrates Nikola Tesla's 160th Birthday

The Long Island Section Historical Committee, including IEEE Life Members and other members of the Section, attended the Tesla Science Awards Ceremony at the Tesla Science Center at Wardenclyffe, New York, on 10 July 2016. The Section's Executive Committee felt that it should take advantage of this historic opportunity to celebrate Nikola Tesla's 160th birthday. As such, Long Island Section Chair M. Nazrul Islam presented the following award plaque to the Center, which reads:

The IEEE Long Island Section Commends
TESLA SCIENCE CENTER
AT WARDENCLYFFE
For its determination to stimulate innovation and to honor the prolific inventor, Nikola Tesla, through the creation of a world-class science, technology, and engineering educational facility and museum and featuring the historic Wardenclyffe laboratory of the famed inventor as its centerpiece.

The Wardenclyffe facility presently does not qualify for an IEEE Historic Milestone, as it is not yet in operation and is still undergoing a complete renovation.

Five Speakers presented papers at the event:

- M. Nazrul Islam—chair of the Long Island Section and vice chair of the Section's Photonics Society and Membership Development Committee. He is an associate professor and chair of the Security Systems Department at The State University of New York–Farmingdale. He provided an overview of the IEEE and the Long Island Section.
- Jesse Taub—historian of the IEEE Long Island Section and its Awards chair. Taub became a Fellow of the IEEE in 1967 for contributions to microwave and millimeter wave technology. He presented, "What Electrical Engineers Can Learn from Tesla."
- Eric Forsyth—IEEE Fellow and a 2000 recipient of the Halperin Prize, awarded annually for research in the field of power transmission development. He detailed, "Tesla's Patent for Long Distance Electric Power Transmission."

From left: Lou Luceri, Region 1 Life Member group coordinator; Peter Eckstein, president of IEEE-USA; and Vic Zourides, chair of the Long Island Section Historical Committee.

- Milutin Stanacevic—member of the faculty of the Department of Electrical and Computer Engineering at Stony Brook University, New York, where he is currently an associate professor. His talk was "Tesla and Wireless Energy Transfer."
- Davor Dokonal—chair of the IEEE Long Island Computer Society and editor of *The Pulse of Long Island*, the Section's newsletter. He is a principal at AED Technology working as a business and technology advisor. He presented "Tesla, an Inspirational Force."

After the presentation, Jane Alcorn and Marc Alessi, the president and executive director, respectively, of the Tesla Science Center, joined members of the History Committee for a group photo. Other special guests in attendance were Eleanor Baum, member of the IEEE Life Members Committee and the IEEE Foundation, and Peter Eckstein, president of IEEE-USA.

The presentation was broadcast via streaming video to CR10 Arts (New York), the Nikola Tesla Airport in Belgrade (Serbia), the National Museum of Kragujevac (Serbia), the Ozalj Hydroelectric Power Plant (Croatia), the Jaruga Hydroelectric Power Plant (Croatia), and the University of Maribor Library (Slovenia).

Daytona Section LMs Air It Out

Life members (LMs) were very busy on Thursday 7 April 2016 at the DeLand Municipal Airport. Ten Daytona Section LMs and three guests met with Pine Pienaar, sales and service manager for Skydive DeLand, for an informative presentation about his firm. Skydive DeLand started approximately 32 years ago and is now one of the largest companies in the world in its field. The company has four airplanes, two of which have 22–23 seats and two with 16 seats. In the facility where we met, there is a gear store; both an indoor packing hangar and an outdoor packing area; training rooms; and take-off and landing areas. Several blocks away, the company also manufactures parachutes and other equipment.

It takes roughly 20 min for a plane to reach 13,500 ft. Coming down can take up to 8 min—60–80 s in free-fall and 6–7 min with a parachute deployed. Normally a skydiver opens his/her parachute at about 5,500 ft, and the minimum altitude for opening it is 2,500 ft. Pienaar told us how the civilian skydiving community has helped the military with improvements of parachute gear and accessories. It's been a reversal from the old days when the military led with the technology. Pienaar said that the military still uses the umbrella parachute, which can open as low as 800 ft, getting a soldier to the ground as quickly as possible.

Skydive DeLand has professional parachute packers available to their customers. Many customers prefer the professional and Federal-Aviation-Administration-certified packers, as they can pack a chute in about 5 min (the average parachutist would need 30–40 min) so they can get back into the air more quickly. There was a lively discussion between Pienaar and the audience over the many aspects of sky diving, but we had to limit the discussion to an hour so we could move on to our next venue. But first, we had lunch in Skydive DeLand's restaurant—The Perfect Spot. Most everyone agreed that the hamburgers were pretty good!

Our next stop, about ¼-mile down the road was the DeLand Naval Air Museum. In 1942, the Deland airport became the DeLand Naval Air Station, a training center for Navy pilots flying carrier-based World War II (WWII) fighters and dive bombers. Fifty years later, the Naval Air Museum came into existence, housed in the former Master of Arms residence, donated by the city of DeLand. Harold Bradeen was our tour host. After an introductory video, he explained some of the records, uniforms, and models on display in the main building. Al Helfrick gave us an overview of several of the military radio transmitters/receivers on display (all of which used vacuum tubes).

The museum sports an F14 fighter jet on one side of the main building and a PT boat on the other. Both artifacts are being carefully restored by volunteer groups. Going out the back door, we saw the radial engine removed from the PBY aircraft donated to the museum and a WWII 40-mm portable gun capable of firing up to 200 rounds/min.

A hangar building in the back houses a PBY that crashed into Lake Michigan during a training exercise. The cold waters preserved most of the plane for the 50-odd years it was under water. After the plane was placed in the museum, restoration workers discovered the remains of a signal flag in the engine exhaust duct, which must have caught fire and led to the plane's pilot performing an emergency landing on the lake. Embry Riddle University students are aiding in the restoration of the PBY. Other displays were a Sikorsky EVAC helicopter of Vietnam War vintage, a WWII jeep, and numerous other exhibits of 1940–1970 vintage.

Patrol Torpedo boat PTF-3 was commissioned in 1962 and later stationed in DaNang, Vietnam. In 2001, it was donated to Boy Scout Troop 544, Orange City, and installed at the museum in 2005, where it is undergoing a complete refit.

Our planned hour-long stop at the museum stretched to over two hours and could have been even longer. The museum has wonderful documentation on all of its artifacts, be they uniforms, airplanes, or boats. I think most of us will revisit the museum, as there is a lot more to see than we could cover in the short time we had.

—Ron Gedney
Life Member Affinity Group Chair
Dayton Section

Life Member Profile: Networking Leads to Making a Difference

Jim Palmer joined IEEE while attending the University of California, Berkeley, to network with other students interested in electrical engineering. Since joining IEEE more than 50 years ago, he earned his Ph.D. degree from the University of Oklahoma, where he started his career as an assistant professor of electrical engineering and later served as the director of the School of Engineering and the director of the Systems Research Center.

"The professional contacts and conferences gave me the opportunity to meet with other professionals in the field and learn about the other aspects of IEEE," Palmer explains. "As a new faculty member, IEEE membership provided the opportunity to publish research work and share findings with others working in the same or related areas."

Through networking with another IEEE Member, Palmer was introduced to the IEEE Foundation. When asked why he believes IEEE Members should support the IEEE Foundation, he replies, "The foundation supports so many important programs that reinforce the best that IEEE can do to provide for those in need and to broaden the scope of member activities."

As an annual donor to the IEEE Life Member Fund of the IEEE Foundation, Palmer sees the foundation growing and prospering through the generosity of Members. He adds, "The Foundation supports emerging countries, student activities, and a widening of the membership to be more inclusive and representative of the society as a whole, thus, it is worthy of support from all Members, regardless of grade or interests."

Bested by Bessel Functions

I have a lifelong interest in birds, bird sounds, and bird sound recording. A favorite tool of bird sound recordists is the parabolic reflector with a microphone at its focal point. This tool is highly directional and provides substantial gain at frequencies of most bird sounds, but the magnitude of that gain as a function of frequency is empirically known to be quite nonlinear.

As a senior project in electrical engineering at Cornell University in 1963, I studied the acoustic properties of parabolic reflectors. Classical physics predicts that gain increases monotonically with frequency. As empirical results show this to be far from the truth, I constructed a finite element model of a parabolic reflector and developed mathematical equations to describe behavior in the limit when element size was diminished to zero. The solution was a daunting equation of Bessel functions. I suggested that a quantitative solution would have to await the availability of more powerful computers and concluded the project with a qualitative prediction of the frequency response. An abridged version of my report was subsequently published in *Bio-Acoustics Bulletin*, where it stimulated international interest.

Every so often during the years, while working at Bell Labs, I would ask myself, "Could today's computers render a numerical solution in a reasonable time?" Then one day I received a phone call from a mathematics professor who proposed having a graduate student tackle the solution for his Ph.D. degree. First he wanted to make sure he understood the logic behind the model, so I took him through it step by step, delighted to think that a quantitative solution was in the offing.

Of course, that new interest after more than a decade of stagnation got me rethinking the problem. My sleep that night was suddenly interrupted by one of those "Eureka!" moments. I got up, went to the den, and made a quadratic substitution of variables in the equation that transformed the daunting equation into something that seemed more manageable. I was pleased.

So I cranked the process further and—devastation! The equation simplified to the classical solution that I was trying to overcome. Needless to say, I called the professor the next morning and broke the news, all the while eating proverbial crow.

As a postscript, I have since recognized another element, missing from my initial model, that should explain the difference between the classical and empirical behavior of parabolic microphone systems. Namely, looking at it from an acoustic energy perspective (rather than that of acoustic pressure alone), when the acoustic wavelength is smaller than the size of the microphone diaphragm, virtually all of the reflected energy is captured and any tighter focusing at shorter wavelengths cannot deliver any greater energy to the microphone.

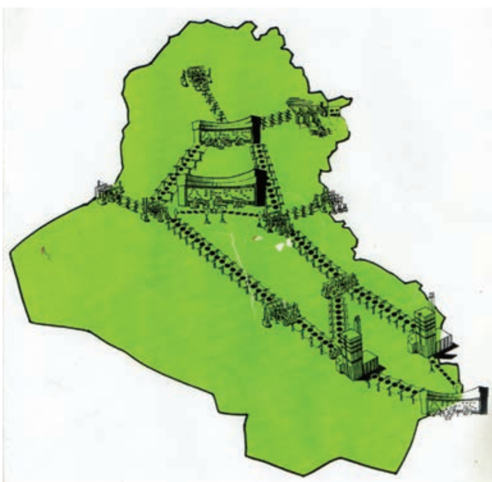
If anybody would like to pursue this challenge further, I would welcome the discussion.

Randolph S. Little, LSM
Basking Ridge, NJ

The Power Control Center Development of Iraq

By 1975, the National Electricity Administration (NEA) was upgraded to the State Organization of Electricity (SOE) for the future planning and implementation of all power projects in Iraq. In 1975, due to booming oil revenue, industries had a high demand of electricity that was more than the existing generation capacity of 2,000 MW, so the SOE invited foreign consultation and bidders to respond, and the job was awarded to the Canadian Consortium of ACRES consultant engineering.

The consultation contract involved 5 × 400-kV substations and 400-kV single lines of more than 1,000 km. In addition, the consultation involved upgrading



The data network of the iraq 400/132 kV dispatch control centers—1982. [*Image credit: Republic of Iraq Ministry of Industry and Minerals (State Organization of Electricity).*]

the existing National Control Center in Baghdad. SOE delegations of Iraqi engineers were sent to Canada to join the consultants in 1975.

For the control centers, ACRES designed one in Baghdad and connected it to existing regional control centers in the south and the north of the country and kept the existing old power line carrier (PLC) communications and remote terminal units, which may create a major catastrophe if center-to-center existing links fail. The National Control Center acted as the central regional control center as well.

I consulted with the SOE authority as an employee as the consultant was not familiar with existing Iraq control system problems, mainly the missing database for power network elements. The SOE board of directors agreed to draw the consultation for control centers only upon my proposal (as an expert in this field) from consultant against compensation for the work done, and I asked to include Indian expert Raman Nair, who worked in the SOE network for ten years, as part of project management to deal with collection of power data.

My specification for control centers modified ACRE's single control center to three control centers and also issued new contracts to Brown & Bovary Co. and Siemens to renew all PLC and microwave telecommunication equipment. The tender for control centers was issued and awarded in 1978 (rather than 1975).

This delay was to the benefit of the SOE network, as approximately 50% of network substations (80 in total) were not commissioned before 1982. During bid negotiations, I raised an important issue of lack of/incorrect/missing data collection and considered the need to provide such data for all existing substations and power stations, which were approximately 40 in total, by adding auxiliary relays and new transducers. The bidders accepted this suggestion, and the contract was awarded to the Swedish company ASEA in mid-1978. Also, the locations of the control centers were very important, and they were modified from their existing locations to be at the center of loads as new control centers in both regions, which were at Khor al-Zubair 400 kV, and Kirkuk 400 kV substations, respectively. The later substations were awarded late in 1980.

Raman Nair started collecting data, testing, and issuing shutdowns to provide the correct operation of the circuit breakers' contact, and MW/MVar transducer readings. By this time, Iraq electricity had a reliable real-time database for the first time for power network.

Finally, with the help of myself and Mr. Nair, the project was completed, and it was commissioned by ASEA in 1982 with Iraqi engineers trained to operate the up-to-date centers. These control centers were the backbone of the Iraqi grid up until 2003.

Basil Al-Fakhri, LSM
Auckland, New Zealand

Now We're Cooking

Maxwell's equations are well known to electrical engineers who are involved in radio communications or with equipment using radio waves. The equations are the very basis reference for many applications we now use in common ways or that scientists use in their research. I was thrilled to find that the IEEE Life Members have dedicated an IEEE Milestone award for Maxwell's work, as well as a commemorative coaster.

My radio career started in 1938, at the age of 13, with amateur radio and then as a radio tech seaman in World War II, followed by my studies at Iowa State University and my first course in radio energy and Maxwell's equations. I had knowledge with respect to the power of the equations during the following years at Collins Radio Co., designing antennas, power amplifiers, and Apollo spacecraft equipment. However, my reference to the equations the entire first half of my career was very routine and ordinary.

Then, I moved to a detailed area of use for the equations in a noncommunications way: the microwave oven. I was now employed at Amana Refrigeration Co. in Amana, Iowa, about 20 mi from my home in Cedar Rapids. I never really wanted to travel a distance to work, but I did. I found the microwave to be a fascinating appliance: large amounts of power were generated and not sent into space but into a box with a large door on hinges. What was I hired to do? I was tasked with stopping the energy from leaking out of the door. I thought, "How should I do this?" I soon found out that there was no easy answer to this question. Over the following 13 years, there were several ways in which an analysis of Maxwell's equations revealed answers.

The vector representing energy flowing around the door seal was stopped simply by placing slots in the seal around the perimeter of the door. Why did this work? The equations say that if one component of the radio wave is stopped, then all components die—the electric and magnetic energy as well as the current flow induced into the door seal. The slots stopped the current flow.

Another vector is at 90° to the above energy. Tuning the door seal is much like tuning the dial on radio station, but in this case we tuned for the weakest signal. The mathematics for this is an expansion of Maxwell's equations. Tuning in a radio station results in an improvement to the radio signal. In the case of the microwave oven, the idea is to suppress the signal by tuning for a weaker signal. This is known as tuning out the oven signal.

Maxwell's equations were with me during my career at Amana Refrigeration. My goal was accomplished. It was not easy, but the results were well worthwhile, as there are millions of microwave ovens around the world with no energy leakage due to those amazing equations.

Arnold M. Bucksbaum, LSM
Cedar Rapids, IA

An Unusual Request

Back in 1970, I was working for a small startup company that specialized in microwave components and subsystems. One day, I was called into the boss's office along with our chief technical expert to meet a walk-in customer. He turned out to be the chief engineer at a local television station. They were broadcasting on channel 9, which in round numbers transmits on 180 MHz. His transmitter comprised separate visual and aural transmitters. The original design for the aural FM transmitter originally contained a 10-kW frequency tripler stage followed by a 50-kW final amplifier stage. Since the Federal Communication Commission (FCC) had noted that the aural signal typically had a wider range than a useful visual signal, they put out new standards that required stations to reduce their aural power to more closely match their visual transmitter's useable range.

The channel 9 chief engineer accomplished this by shutting down and removing the 50-kW final amplifier stage and operating with just the 10-kW tripler stage as the final output. The input to this stage was a 60-MHz signal. The station had been operating in this configuration for a period of time when the chief engineer received a call—not from the FCC but from an engineer at the Federal Aviation Administration (FAA). It seems that with the final stage not there, the attenuation at 120 MHz, the second harmonic of 60 MHz, was insufficient to prevent significant radiation at that frequency. The radiation was strong enough to cause interference in a 120-MHz repeater station that the FAA maintained somewhere in a remote region of the state. Unfortunately, 120 MHz falls right in the middle of the VHF aircraft band. Not believing the caller at first, the station's chief engineer took his field strength meter home and set it up in his driveway and confirmed that there was finite signal strength at 120 MHz. He asked us to build a filter to pass 180 MHz with low insertion loss while rejecting 120 MHz.

We put our heads together and determined that an open quarter-wave shunt stub at the notch frequency would do the trick. An open circuit at one point on a transmission line results in a short circuit a quarter wavelength removed from that point. A stub is a piece of transmission line branched off of the main line and in parallel with it. I modeled it on the computer and found that the insertion loss at 180 MHz was going to be too high. The stub still looked too inductive at that frequency. Our technical guru suggested that we insert a shunt capacitor in the line at the point where the stub attached to the center conductor to tune out the inductance at 180 MHz. At 120 MHz, the effect of the capacitor would be swamped by the short circuit represented by the quarter-wave stub. Lo and behold, the computer model now predicted success.

This filter had to handle in excess of 10 kW of radio frequency power. The transmission line was a 4-in copper soil pipe with a 1.5-in copper drain pipe center conductor suspended every so many feet by an annular ceramic spacer disk. The chief engineer had brought us a short piece of transmission line and some adapters to transition between 50-Ω type N connectors (about .75 in in diameter) and his 4-in transmission line. After brushing up on our plumbing skills, we constructed a stub out of high impedance coaxial line. For the stub's outer conductor, we used 1.5-in copper pipe and, for a center conductor, we used a piece of welding rod. The capacitor at the joint with the main conductor was fashioned from a 1-in disk brazed to a bolt threaded into the side of the line. The capacitance between it and the center conductor would provide the tuning we needed. We also had a similar capacitor at the open end of the stub to tune its electrical length to exactly 120 MHz. We assembled the device using a 24-in length of 4-in transmission line with the stub projecting out at right angles and brazed in place. We attached it to our trusty HP network analyzer and tweaked the tuning. It passed all of the tests as predicted by the computer model.

We then called the customer in. He came and took the filter, saying he would install it after signoff that night. We were all relieved to see that channel 9 was on the air the next morning. We never heard from the customer again, and channel 9 is still on the air, so I presume it all worked as advertised. We had many unusual challenges during those years but most were related to how small we could make the components. This one was at the other end of the scale.

Dean Chapman, LSM
Camillus, NY

Damage Control

In 1963, I started my first engineering job at American Cable and Radio (AC&R), a subsidiary of ITT World Communications in lower Manhattan. While companies would mostly hire experienced people and few college grads, AC&R was unique in that they only hired raw college grads so they could mold them in their image. The pay was less than at the bigger electronics companies, especially those with government contracts. Making US$120 per week wasn't so bad back then when you consider that is was for 35 h for a standard work week in Manhattan, 9–5 as they say. Though I majored in communications systems as an electrical engineer, I still didn't know very much about how real-world, money-making communications systems worked.

AC&R was one of three American companies that were considered international data carriers. Since 1956, when the first transatlantic telephone cable went into service, AT&T had a monopoly on such traffic. When I arrived on the scene, it was about a year after the Federal Communications Commission had ruled that AT&T, which owned all off the undersea cables to Europe, could only offer voice channels and not data channels. If someone wanted to connect computers from the United States to overseas, they had to contract with one of the three data carriers that, in turn, would lease channels from AT&T. We could also offer combined voice and data service.

My first assignment was to find out what was wrong with a printed circuit card, called a serial to parallel converter. This 14-in × 8-in card contained a series of transistors configured into what in those days were called "Flip-Flops." Cards like these were used in Telex, a forerunner of today's e-mail. Solid-state circuitry was "quietly" (no pun intended) replacing mechanical relays and vacuum tubes in switching equipment. Messages would be converted into a punched-paper tape, where patterns across the tape of eight holes and no holes would represent each letter. Thus, I could exercise the card with a test tape and reader and see if the card transformed the eight parallel 1s and 0s into a serial stream of data. I was told to sit in front of a lab bench with the card plugged into a test setup and, with an oscilloscope and probe, check the card to see why it wasn't working properly. Since we also had lab techs in addition to engineers, any component change that I thought should be made could be completed not by myself but by a technician. I guess the techs belonged to a union.

I recall there was only one class at City College of New York on solid-state circuitry. I had learned all about diodes and triodes but little about transistors as devices, let alone in operating circuits. Since I hadn't a clue as to what I was doing, the techs got fed up with me in just three weeks and refused my requests for component changes. From then on I decided to make the component changes myself. This was the first time in my life I ever used a soldering iron. After six weeks my boss said to me, "You have put $600 damage into a $300 board. From now on you will be a systems engineer and not a hardware engineer." I was very relieved to have no more burns from the soldering iron.

Len Jacobson, LM
Long Beach, CA

Phoning It In

In the mid-1960s, I worked for Automatic Electric, Inc. (AE), which was the manufacturing arm of the General Telephone system, namely General Telephone and Equipment (GT&E). The relationship was similar to what Western Electric was to the Bell Telephone system. As such, AE made telephones by the millions. Phones in that era included several varistors in their internal "networks" to quell loud or annoying clicks or pops that were created by switching the 50-Vdc telephone line operating voltage. These varistors were also manufactured at AE and were of the silicon-carbide (SiC) variety. The source of the carbon was hard coal (anthracite). To maintain consistency from lot to lot and year to year, AE purchased and operated a coal mine.

SiC varistors are the same type that are universally used by utility companies as lightning arresters up until the introduction of metal oxide varistors (MOVs) in more recent history. While the MOV types have a sharper curve (reduction in resistance to rising voltage). the SiC types normally contained a small air gap. This prevented follow-on currents when an arrestor heated up after conducting a surge to ground. The follow-on current issue is significant, since varistors have a negative temperature coefficient in addition to the negative voltage coefficient of resistance.

James S. Nasby, LM
Skokie, IL

Afghan and Again

One of the memories of my experience working on the design of the transmission line from Kajakai to Kandahar in Afghan-istan was a meeting at the office of the national electric utility. On the grounds outside the building, laid out on homemade tables, were blueprints whose corners were held down with stones to keep the wind for blowing them away. The meeting was with the head of the utility, his second in command, and the United States Agency for International Development (USAID) officer for Afghanistan. My company had the contract for the design of the line whose route skirts the town of Lashkar Gah, and the purpose of the meeting was to extend the scope of the contract to include the design of a small substation to serve the town. The USAID officer was advocating the contract extension, but the head was adamant in not approving the proposal. The second in command said nothing but spent the time methodically moving prayer beads from one hand to the other. The meeting broke up without an agreement. The scuttlebutt that I heard later was that my company had passed money to the utility head for the original contract and that he was not about to approve an extension without an additional contribution. However, we eventually did get the contract extension, and the substation was designed and built.

I have some good memories of that project. On level ground, beyond the mountains in which the power plant is located, the line is supported on concrete poles. These poles have hollow cores for lightness made by pouring wet concrete into a mold, then spinning the mold on its longitudinal axis, which, through centrifugal force, caused the concrete to form about the mold and provide a hollow center. It was a clever idea. The plant was furnished by the Betoma Company of Germany and flown to the site. Another memory is of an elegant villa on the outskirts of Kandahar whose front lawn was to be the location of a tower spotted from our plan and profile drawings. We moved the tower, and I have often wondered if the owner of the villa would have been grateful had he been aware of our consideration.

—Robert Elliott, LM
Ross, CA

A Model Citizen

I had just joined Lawrence Radiation Laboratory (LRL) in March 1971, during the middle of a radiation-induced foci, and was somewhat surprised shortly after to be called to the office of one of the associate directors of the laboratory to justify accepting what was then a year of financial support from a military interdepartmental procurement request that was received from the U.S. Coast Guard naming me as a principle investigator. It seems that a gentleman with whom I had earlier discussed the possible computer modeling of long-range navigation (LORAN) antennas had found some money and had sent it without even receiving a proposal. It turned out that I had to essentially write a proposal to the laboratory to accept the money, as this was in the days when management was not all that enthusiastic about accepting outside support, especially on the engineering side.

Fortunately, the work did get underway, and we proceeded with our first modeling project, the sectionalized LORAN transmitting (SLT) antenna. It was a large structure in the shape of a square, 1,420 ft per side, at which were placed 690-ft-tall towers from which four triangles of wire were draped, all of which met at a center feed point. This size was required by the extremely long wavelength of LORAN C, about 3 km. Of interest was the variation of the antenna impedance around its operating frequency of 100 kHz to include the effect of the Earth's surface and what was needed by way of a ground screen (a network of wires usually buried in the ground) to achieve satisfactory performance.

This was during the first decade of the development of computer codes for the electromagnetic modeling of such problems, and there were few guidelines available to follow in designing a numerical model for this purpose. After a few false starts, we were able to develop results that agreed satisfactorily with measurements, within 10–20%. We were even able to include various ground screens in the computer model and develop an estimate of the influence of tidal variations that the subsurface salt water level had on the antenna. The computer model in this case was based on a sequence of connected wire segments to approximate the shape of the structure of interest. For the SLT, we used 237 segments, which were considered a large problem at the time, since the solution required the computation and solution of a 237 × 237 matrix of complex numbers for the 237 segment currents to be found. Computer resources were limited, and it took about 2 min on a CDC-7600 computer to obtain a result at a single frequency. Personal computers now are in the range of 10,000-times faster, and problems having a number of unknowns in the millions are feasible. Of course, developments in computer hardware as well as analytical developments have both worked to make this possible.

Edmund K. Miller, LF
Lincoln, CA

The Power of the Ontario Hydro Research Division

In the spirit of documenting the history of the electrical power industry, I feel it is of value to inform readers of the *IEEE Life Members Newsletter* of an archive of material related to the work performed over eight decades at the Ontario Hydro's W.P. Dobson Research Laboratories in Toronto. Ontario Hydro was a public company owned by the province of Ontario, and it was responsible for the generation, transmission, and distribution of electrical power to all citizens, companies, and institutions in the province.

The archive was collected by David Young, who served as editor of *Research Quarterly*, the technical publication distributed free to many utilities around the world. Sadly, David passed away, and his book based on this collection did not get finished. The material covers the complete lifetime of the Research Division from 1912 to 1994. Known as the W.P. Dobson Collection, it is housed at Queen's University Archives (QUA) located in Kingston, Ontario. Should any reader wish to consult the extensive holdings, including all of David's research files, correspondence, subject files, reports including annual reports, newsletters and other printed material, records relating to former employees, donations to David's research from other individuals, photographs, moving image and sound recordings, and, of course, his extensive 1,275-page manuscript "Dobson Chronicle: A History of Ontario Hydro's Research Laboratories, 1912–1994," please feel free to contact the QUA at 613-533-2378, or visit in person and cite Locator #5110.2. The QUA staff will be more than happy to assist.

The Research Division was organized along academic lines with separate departments specializing in chemical, civil, electrical, and mechanical engineering; metallurgy; and operations research. Over time, the division built several, state-of-the-art, specialized laboratories, including high-voltage and high-current laboratories and mechanical testing facilities, including those with earthquake simulation capabilities.

The work done in the division paralleled the growth of the utility. It initially dealt with heavy concrete construction, as the hydraulic resources in the province were exploited, and more recently supported the growth of the coal and, more extensively, nuclear-powered generation. As transmission voltages increased to allow longer and longer connections from the remote hydraulic resources in the north of Ontario to the town, cities, and industrial load centrs in the south, electrical studies grew to ensure reliable operation of the grid. Much of the work was reactive, investigating the causes of various failures, but there were many notable new developments as well.

The laboratory facility still stands as a privately owned company, named Kinectrics, and the specialized laboratories are still in use. This is now a private company providing testing services to the industry. Some of the retired staff members meet monthly to discuss developments in the industry, among other topics. We consider ourselves very fortunate to have worked at the Ontario Hydro Research Division during its golden age.

David Havard, LSM
Mississauga, Ontario,
Canada

By the Numbers

In the mid-1950s, I ran a massive (tens of thousands of discrete devices) reliability testing program of transistors, diodes, and resistors that were to be used for the (ground-based) computer for the Titan intercontinental ballistic missile. I was an employee of Inland Testing Laboratories, a subcontractor to Remington Rand Univac. At the time, I also was a Corps of Engineers reserve officer—a "mobilization designee" to the Engineer Laboratories at Fort Belvoir. The arrangements were that I only had to spend one out of three annual active duty tours at Fort Belvoir—the other two could be anywhere that would take me. It just so happened that one tour was at the Navy Electronic Laboratories at Point Loma, San Diego, which was involved in reliability issues. This put me in the rather unusual position of being an officer in Army uniform, at a Navy facility, conveying information concerning an Air Force program.

Incidentally, about ten years later, as a principal scientist at Booz Allen Applied Research, I led a study for the U.S. Postal Service intended to find improvements to the Philco optical character recognition. The main problem at that time was in finding the city, state line reliably, given the great variety of address formats (many with extraneous text) in use. We used heuristics—the most important (if obvious) observation being that the city, state line usually would be near a five-digit (the time being before ZIP-plus-4) numeric. We were informed that Philco was directed to implement our results.

Paul Gottfried, LSM
Evanston, IL

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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 before hand, you may contact Craig Causer, managing editor, by e-mail at lm-newsletter@ieee.org. The deadline to submit an article for possible inclusion in the next issue is 3 April 2017. Please include your Life grade, town, state, country, phone number, member number, and/or an e-mail address with your piece.

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