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IEEE life members newsletter

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Enhancing Life Members' Engagement

Joe Cruz, Chair, IEEE Life Members Committee

In my message that appeared in the June 2014 issue of the *IEEE Life Members Newsletter*, I congratulated and welcomed those that became Life Members (LMs) on 1 January 2014: Life Fellows, Life Senior Members (LSMs), and LMs. I noticed that a significant number of new LMs are at the Member grade. To become an LM at age 65, one must have 35 years of IEEE membership. I am sure that most if not all of the new LMs have sufficient achievement to qualify for Senior Member grade. I discussed this at the recent August meetings of the Life Members Committee (LMC) and the Member Engagement Life Cycle Committee (MELCC). I received positive reactions from the LMC and the MELCC to explore how we could assist those who are at the Member grade level in their nominations for elevation to the Senior Member level before becoming LMs. Also to be addressed is the nomination of existing LMs for elevation to LSMs. I will explore ways to accelerate the nomination process with the IEEE Admissions and Advancement Committee. If you have thoughts on this, please contact me at jbcruz@ieee.org.

IEEE Life Members Committee Chair Joe Cruz

One proposal that was approved at the August meeting of the LMC was to develop a budget and explore the possibility of providing funding to each of the IEEE Regions that are interested in holding an annual Regional Meeting of Life Members Affinity Groups (LMAGs). The LMC is working with the Life Members Regional Coordinators to develop these plans. If you have thoughts on this, I encourage you to write to me and I will forward your suggestions to your Regional Coordinators. Once the budgetary needs are known, the LMC will be able to evaluate how we might proceed with this in the future.

Also approved at the meeting was a proposal to create a new LM award. The award would be given to an LMAG to recognize the group for its leadership and/or innovation in the promotion of LM activities and/or the Life Member Fund (LMF). This is still in the beginning stages of implementation as it needs additional approvals within the IEEE organization structure.

The LMC members who were at the committee meeting at IEEE Sections Congress in Amsterdam took advantage of the opportunity to interact with the Section leadership in promoting greater member engagement in their Sections through activities sponsored by the LMAGs. The LMC and the IEEE Foundation were both sponsors of Sections Congress. Throughout the two-day event, LMC members urged the 1,000 IEEE delegates from 90 countries in attendance to implement activities of interest to you—the IEEE LMs.

The LMs Fund and the IEEE Foundation Fund continue to partner to support projects that are important to LMs and IEEE. To learn more about the 2015 plans for the IEEE Foundation/LMs Grants Program, see the "What Do You Propose?" article on page 5. I urge you to join me in generously contributing to the LMs Fund of the IEEE Foundation as you renew your free IEEE life membership for 2015. Your support enables the LMC to support many worthy programs.

Shop AmazonSmile, Donate to the IEEE Foundation

AmazonSmile provides a simple and automatic way for you to support the IEEE Foundation. While you shop at smile.amazon.com, you'll find the same Amazon.com products with an added bonus: the IEEE Foundation receives 0.5% of the purchase price.

To set up your IEEE Foundation/AmazonSmile account:

1) Visit http://smile.amazon.com.
2) Select "IEEE Foundation, Inc."
3) Shop eligible AmazonSmile products.
4) AmazonSmile Foundation donates 0.5% of the purchase price to the IEEE Foundation.
5) Bookmark smile.amazon.com to use for future shopping and turn your purchases into a gift to IEEE.

Please contact donate@ieee.org with questions. Thank you for your support, and happy shopping!

Grants Continue to Fund Worthy Programs

The IEEE Life Member Committee (LMC), a joint committee of the IEEE and the IEEE Foundation, manages the IEEE Life Members Fund (LMF). In coordination with the IEEE Foundation, the fund supports activities of interest to Life Members, potential engineers, and engineering students. It is supported by the generosity of IEEE Members. The IEEE LMF is pleased to support the following programs.

Regional Science and Technology Camp (US$2,000): The Regional Science and Technology Camp 2014 offered fun, hands-on camp programs that were designed to engage youth and children to explore topics in innovative science, engineering, technology, modern farming and entrepreneurship. A program of the LOG`EL PROJECT Science and Technology Centre at LOG`EL Project, the camp activities used an exploratory learning approach that is focused on "learning by doing" while at the same time focusing on addressing real-life challenges within communities using science, technology, and engineering.

IEEEmadC 2014—Global (US$9,775): The goal is to build on the success of the 2013 competition in Region 8 and to expand the competition globally for all IEEE Student Members. The contest is designed to bring additional practical activities to IEEE students and motivate nonmember students to join the IEEE. The uniqueness of this competition is that only IEEE members can compete, and the applications developed for it need to be in accordance with IEEE goals.

Robotics Mobile Lab (US$35,000): The Robotics Mobile Lab is a portable lab for educating school students about robotics engineering and concepts, building real robotics projects to perform tasks, using sensors, learning robotics programming and its impact on the society, teaching how robotics is changing the future, and inspiring students to pursue robotics as a future career. The program provides hands-on projects, workshops, activities, and camps for school students in Egypt, and the lab includes robotics hardware, software, and tools that can be moved from one school to another to set a working area where groups of students practice practical and hands-on robotics projects.

La TECHLa Powered by Black Girls CODE and the Latino Startup Alliance (US$85,000): Black Girls CODE is a nonprofit organization that increases the participation of women of color in computer science by facilitating early involvement and interest in the field. Black Girls CODE and the Latino Startup Alliance plan to build upon the success of the collaboration of their pilot project in the Mission District of San Francisco on 21 May 2013 by launching Intro to Coding for Black/Latina Youth 2014. The plan is to collaborate with key partners in each city to reach girls in the United States, Puerto Rico, and Guadalajara, Mexico. Black Girls CODE requested the grant for La TechLa Powered by Black Girls CODE and the Latino Startup Alliance to be held from January to December 2014.

SEEC (Electrical and Computing Engineering Week) (US$7,220): The Semana de Engenharias Elétrica e de Computação (Electrical and Computing Engineering Week) will discuss topics regarding technology and networking and soft skills while uniting students, professors and professionals, such as engineers, to improve and develop knowledge about those topics. The project focuses on the discussion regarding technology and innovation, bringing experiences that are more practical to the subjects learned in class.

The IEEE Foundation invites grant applications from IEEE organizational units for projects that address predefined themes identified by the IEEE Foundation. The *themes align with the IEEE Foundation's mission to "enable IEEE programs that enhance technology access, literacy, and education." A joint committee of the IEEE Foundation Board of Directors and the IEEE LMC reviews the grant applications. Funding is provided from the IEEE Foundation Fund and IEEE LMF.*

The application, current themes, deadlines, and specific criteria are online at www.ieeefoundation.org. Prior to submitting an application online, please review the "Innovative Projects" section of the Web site. You can support the grants program by donating to the LMF online at www.ieee.org/donate.

Students Benefit from Grant-Funded Robotics Camps

Robotics summer camps now reach deeper into Southern California communities thanks to an IEEE Foundation grant. Whitney High School (WHS) in Cerritos, California, inspires youth ages 9–17 to explore the world of engineering. Since 2003, the WHS Robotics Club has promoted the application of science and math by hosting summer RoboCamps based on the internationally renowned robotics competition organizations FIRST and VEX Robotics.

With each session, the students were introduced to learning and strengthening real-world engineering practices. The kids worked together in teams designing, building, and programming robots to accomplish missions for the final camp competitions within a week. Most of the students wrote their first computer program at RoboCamp. They developed an understanding of how program code monitors sensors and drives motors—an epiphany that connects physics to computer science. The IEEE grant supported three RoboCamps spread over four weeks with 44 students and 27 student-teachers building 66 computer programs written in three different languages controlling 22 robots. In 2014, the number of students increased by a factor of 50%.

Thanks to the IEEE Foundation Grant sponsored by the IEEE Life Members Committee, WHS Robotics camps were able to reach a greater number of kids.

Until 2013, WHS Robotics could only support a limited number of seats in their LEGO and VEX sessions. However, thanks to the IEEE Foundation grant sponsored by the IEEE Life Members Committee, WHS Robotics camps were able to reach a greater number of kids, including those who could not afford to attend robotics camps. Additionally, with IEEE support, WHS Robotics was able to organize a new RoboCamp geared toward high school students using the TETRIX robotics system.

With each RoboCamp session, the students were introduced to learning and strengthening real-world engineering practices.

WHS Robotics club members (7th–12th-grade students) developed the course content and taught all of the camp courses. RoboCamp student teachers require mastery of the science and mathematics material, public speaking, and time management. Each of the 27 student instructors benefited from the teaching experience gained. Dr. Marianne Louie, an IEEE Member, reviewed the curriculum, and Terrance Domae, an IEEE Computer Society member and robotics club mentor, provided technical direction to the club's camp teachers. Long-time WHS teachers and WHS Robotics club founders Sandra Bruesch and Marilou McSherry provided the basis of the curriculum and oversight of the courses.

Benjamin Domae and and Proud Heng

The College of New Jersey Uses Grant to Showcase the Sarnoff Collection

In December 2012, the IEEE Life Members Fund awarded The College of New Jersey (TCNJ) a major grant for the development of a study center for the David Sarnoff Collection. This grant provided funding for a key element of the Sarnoff Collection in its new home at an institution of higher learning.

As many IEEE Members may know, the Sarnoff Collection originated in 1967 in the David Sarnoff Research Center on Route 1 in Princeton, New Jersey. At that time, it was named the David Sarnoff Library, in honor of the long-time chair of the Radio Corporation of America (RCA), and it housed its namesake's papers, awards, honorary degrees, and memorabilia. Over time the library grew to contain RCA reports, notebooks, publications, and artifacts. It is these artifacts, more than 6,000 objects related to the history of RCA, that were donated to TCNJ.

The donation of the Sarnoff Collection to TCNJ was an invaluable gift and not just due to the monetary value of historic artifacts, which include David Sarnoff's telegraph key; the first color television picture tube; the first commercially available electron microscope; and early examples of magnetic core computer memories, thin-film transistors, and liquid crystal displays. Perhaps the greatest value of the collection for the college is as a teaching tool—a truly unique means of instructing and inspiring students about the major developments in electronics and communication made by the engineers and scientists at RCA.

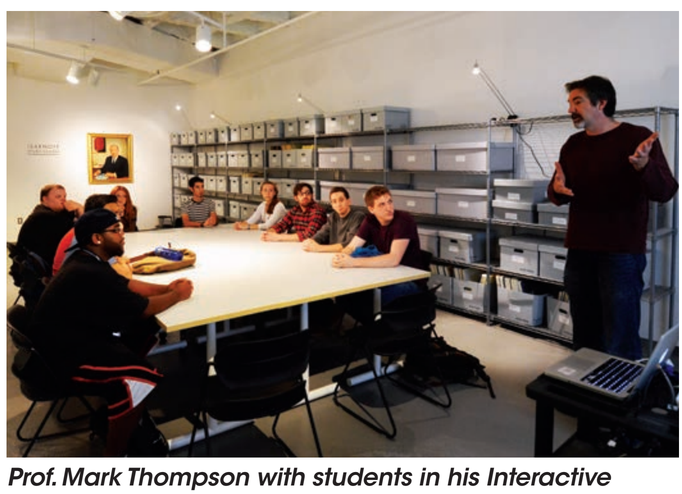
Through funding from the IEEE Foundation grant, the Study Center has become the central location for educational engagement with the Sarnoff Collection. Located adjacent to the inaugural exhibition, *Innovations that Changed the World: An Introduction to the David Sarnoff Collection,* the Study Center occupies approximately 1,000 ft^2 and includes a seminar table, computers, projector, and screen, thereby providing facilities for groups of up to 20 people. Additionally, the IEEE Foundation grant funded the archival rehousing of hundreds of artifacts from the collection, which are now accessible to students and scholars in open "study storage" within the center.

Among the many TCNJ classes that have visited the Sarnoff Study Center since its opening in October 2013, one of the most exciting and fruitful has been an Interactive Exhibit Design course taught in the Department of Interactive Multimedia. This course, which was offered in the fall of 2013 and was held again in the fall of 2014, uses the artifacts in the Sarnoff Collection as the direct source material for the creation of cutting-edge, interactive exhibit projects. Students in the 2013 course created augmented reality apps; video games; models that simulated telegraphy and early computing; and interactive timelines of the history of RCA, radio, and television. These projects were showcased at an Interactive Exhibit Expo in February 2014, which was attended by over 100 members of the college community and outside visitors.

The Study Center has also hosted classes including the History of Science; Society, Ethics, and Technology; Press History; Informal Science Education; Introduction to Interactive Computing; Materials and Methods of Teaching Science; and Introduction to Media Studies.

Students Deborah Fade and Niveda Harishankar catalog recent acquisitions in the Sarnoff Study Center.

Volunteer and IEEE Senior Member Dr. Jonathan Allen at work in the Sarnoff Study Center.



Prof. Mark Thompson with students in his Interactive Exhibit Design course in the Sarnoff Study Center.

In addition, the Study Center serves a crucial role as an orientation space for outside visitors, which during the past year have included numerous retirement groups from throughout the region, participants in the Trenton Computer Festival, and members of the David Sarnoff Radio Club. Undoubtedly the most prestigious visitor has been Princess Elettra Marconi, daughter of wireless pioneer Guglielmo Marconi, who toured the Sarnoff Collection and Study Center in June 2014.

Along with serving as a classroom and meeting area, the Study Center provides essential workspace for scholars, students, and volunteers. One of the most diligent and talented volunteers is Jonathan Allen, Ph.D. (in physics) and Senior Member of the IEEE. Among his many contributions to the collection, Dr. Allen has donated a 1913 Victrola VV-VI phonograph and restored a 1929 RCA Radiola 18 radio and a 1948 RCA 8TS30 television.

As more people, both within and outside the college, learn about the Sarnoff Collection and Study Center, it will continue to grow and thrive as a space to explore the important history of 20th-century electronics and technology.

Emily Croll, Director
TCNJ Art Gallery and Sarnoff Collection

What Do You Propose?

It's time to think about what you might propose for a project under the theme: *increase the understanding of technology and its critical role in meeting global challenges and improving the human condition.*

The IEEE Foundation Grants Program has funded a multichannel educational program of IEEE Women in Engineering encompassing a microsite, video, and smartphone apps to inspire girls to consider careers in engineering. Twenty-six libraries in the Midwest have provided science kits for children fueling technology's future and building a technologically literate society. Grant-funded projects have developed a microgrid in Uganda; educated Oregon residents about electricity supply; supported science, technology, engineering and math projects in all corners of the globe; and much more. The Grants Program is a critical component of the Foundation's mission to enable IEEE programs that enhance technology access, literacy, and education. Does your IEEE unit have a project worthy of Foundation grant funding?

In 2015, the IEEE Foundation Grants Program will invest approximately US$400,000 in up to 20 grants ranging from US$5,000 to US$100,000 to IEEE organizational units. Proposals are invited, beginning 1 January 2015, from IEEE organizational units for projects that inform the public about technical issues such as, but not limited to: energy, health care, cybersecurity, Internet governance, and environmental change for the purpose of fostering balanced factual discussion and understanding of a current public issue. Eligible projects should result in the creation of materials and activities such as presentations and/or simulations that are suitable for one or more of the following audiences: secondary school/college students, secondary school teachers, IEEE groups, local community groups, and technology policy makers.

So what do you propose? Grant applications are only accepted one time each year from 1 January to 1 August. We look forward to learning about your project. For more information about applying for a grant, please visit the IEEE Foundation Web site www.ieeefoundation.org/Grants.

The Invention of the First Transistor Is a Commemorative Coaster

The invention of the first transistor revolutionized the electronics field and eventually ushered in the information age with small, low-power electronic devices and the development of low-cost integrated circuits. Walter H. Brattain and John A. Bardeen, under the direction of William B. Shockley, discovered the transistor effect and developed the point-contact germanium transistor at Bell Telephone Laboratories, Inc., at the end of 1947. The transistor quickly replaced existing electronic tube-based electronics devices and ushered in the beginning of solid-state electronics, which has been cited as the most important invention of the 20th century. This directly led to developments in solid-state devices that revolutionized the electronics industry and changed the way people around the world lived, learned, worked, and played.

The Invention of the First Transistor is the eighth in a series of limited-edition coasters commemorating various historic IEEE Electrical Engineering and Computing Milestones.

To celebrate this important milestone, those who donate US$125+ specifically to the Life Members Fund (LMF) of the IEEE Foundation beginning in October 2014 through September 2015 will receive the limited edition coaster depicting the Invention of the First Transistor.

The Invention of the First Transistor is the eighth in a series of limited-edition coasters commemorating various historic IEEE Electrical Engineering and

Computing Milestones. The first seven depict Telstar, the Panama Canal, Japan's Bullet Train, the ENIAC computer, the Atom Smasher, Maxwell's Equations, and the Landing of the Transatlantic Cable. Previous years' coasters are also available for a US$125 donation each.

The LMF provides grants to new and ongoing projects that are beneficial to potential engineers and engineering students. (See "Grants Continue to Fund Worthy Programs" on page 2.) Your gift will both preserve the memory of the invention of the first transistor and support future technological innovations.

The IEEE History Committee established The IEEE Milestones in Electrical Engineering and Computing Program during the centennial year as an ongoing means to honor and commemorate significant technical achievements in the history of IEEE fields. For more information, e-mail donate@ieee.org.

Donors who receive low-cost articles with a fair value exceeding the U.S. IRS threshold will be notified that the tax deductible amount of their charitable gifts(s) have been reduced by the fair value of the items.

Help Transform Lives While Confirming Your LM Profile

Did you know that the IEEE Life Members Fund (LMF) is 70 years old? The American Institute of Electrical Engineers originally established the LMF in 1944 to collect volunteer dues payments from "members-for-life" that no longer had to pay dues. In 1973, the LMF was transitioned to the IEEE Foundation and began depending on the altruism and generosity of IEEE members and friends to enable a robust set of initiatives of interest to Life Members (LMs), potential engineers, and engineering students.

As another year comes to a close, please take time to reflect on how your IEEE membership has influenced your career and enhanced your opportunities. LMs continue to receive the same benefits that are available to all IEEE members without the expense of membership dues.

A donation to the LMF is a way to "pay it forward" and commit to our important work. Your donations support activities such as showing students the excitement of science, technology, engineering, and math; empowering young minds to pursue careers in IEEE fields of interest; preserving the legacy that IEEE members helped create; encouraging LMs to stay active in IEEE; and many others.

You may choose to designate your donation, in any amount, to the LMF through the enclosed reply envelope, online at ieee.org/donate, or as you confirm your LM profile and membership to IEEE.

As a special thank you for your support, a donation of US$75 entitles you to receive an LM pin; for US$125, you will receive the 2014/2015 limited edition commemorative coaster celebrating the "Invention of the First Transistor" (see page 5 for more information); and for US$200, you will receive both the LM pin and coaster.

There is so much more that we can accomplish together to transform lives through the power of technology and education. Visit ieeefoundation.org and learn more about:

- maximizing your donation through your employer's matching gift program
- donor recognition groups such as the **IEEE Goldsmith Legacy League**
- how to receive timely updates of our activities on Facebook and Twitter
- making your gift electronically at ieee.org/donate.

Be *Forever Generous*: Leave a Bequest to the IEEE Life Members Fund

Did IEEE play a role in your life story? If the answer is yes, a bequest to the IEEE Life Members Fund (LMF) of the IEEE Foundation is an excellent way to pay it forward to the next generation of engineers.

Bequests to the IEEE LMF of the IEEE Foundation should be worded as follows:

I give the sum of $____ [or all (or stated percentage) of the rest, residue, and remainder of my estate] to the IEEE Foundation, Incorporated, New York, NY, USA for the benefit of the IEEE Life Members Fund."

Notify the IEEE Foundation of your intentions to leave a bequest in your will or trust, and you will be invited to join the elite legacy giving donor recognition group—the **IEEE Goldsmith Legacy League** and be *Forever Generous*. Donors may choose to remain anonymous.

For more information visit www.ieeefoundation.org, contact Karen Galuchie in the IEEE Development Office at +1 732 562 3860 or e-mail donate@ieee.org.

Correction: IEEE Life Members Fund 2013 Honor Roll of Donors

In the June 2014 *IEEE Life Members Newsletter*, a segment of the Honor Roll of Donors was omitted. We apologize and would like to take this opportunity to thank and recognize the following donors for their 2013 support of the IEEE Life Members Fund of the IEEE Foundation. Your generosity enables the IEEE Life Members Committee to support philanthropic activities that encourage students and young electrical engineers to pursue careers in engineering, investigate the history of electrical engineering, and represent the interests of IEEE Life Members or similarly mature Members.

Patron ($5,000 to $9,999)
Diane and Gary Tooker, LSM

Associate (US$2,500 to US$4,999)
Robert N. Riley, LSM

Sponsor (US$1,000 to US$2,499)
Mr. and Mrs. James P.G. Dalton, Jr., I
Thomas H. Grim, LSM
Victor B. Lawrence, Ph.D., LF
Robert H. Rediker, LF
Donald R. Shepherd, LM
Dr. and Mrs. Ralph W. Wyndrum, Jr., LF

I: Individual, LF: Life Fellow, LM: Life Member, LSM: Life Senior Member.

We apologize for the error. The IEEE values the generosity and commitment of all of our donors.

The IEEE Development Office makes every effort to ensure the accuracy of the listing, including the proper acknowledgment of gifts and correct spelling. Please notify us of omissions or errors by sending an e-mail to donate@ieee.org or calling +1 732 465 5871.

Announcing the 2015 IEEE Life Member Technical Tour

The series of technical tours organized through the IEEE Life Members Committee (LMC) will continue next year with a three-legged tour in France, Switzerland, and Germany, based on three of the most interesting cities in Europe. The tour will begin on 6 May 2015 in Paris, move on to Geneva, and finish on 17 May in Munich.

The basic plan follows that of previous tours: in each city a base hotel has been chosen, from which the local tours will be organized. The tour group will be expected to make their own travel arrangements to arrive in Paris by 6 May and to depart from Munich on 17 May. Individuals may wish to extend their own itineraries beyond these dates at either end of the tour.

A tour company, Insight Travel, has been engaged to handle the hotel bookings and local travel logistics. Transportation will be provided for all of the local visits as well as for the intercity travel.

The final details of the local itineraries will be published in the coming months on the LMC Web site, but the preliminary plans include visits to several IEEE Milestones (the Branly invention of the electrical coherer, the CERN instrumentation labs, and the Swiss watch industry in Neuchatel). Visits are also planned to science museums, such as the Deutsches Museum in Munich and the laboratory in Paris where the standard meter is maintained.

A parallel tour will be offered to tour members' partners, comprising a program of cultural, sightseeing, and shopping trips, some of which will be organized for the whole tour group. These will include a cruise on the River Seine and the Louvre Museum, as well as visits to Oberammergau, Montreux, and Evian.

Further details will be posted shortly and updated on a regular basis. These will include the booking and payment procedures, details of the hotels involved, and the precise itinerary. Continue to check www.ieee.org/lmtour for updates. Any questions about the tour can be sent to lm-tours@ieee.org

Do You Have a Tale to Tell?

One of the most popular features in the *IEEE Life Members Newsletter* is our member-submitted "Tales From the Vault" recollections. If you are interested in submitting your own story for publication in a future issue of the newsletter, you can find more details on page 12.

We are also interested in hearing about Life Member Affinity Group (LMAG) activities. Has your LMAG hosted any particularly successful events this past year? Send your stories and corresponding photos to Craig Causer at c.causer@ieee.org. Please keep all articles between 500 and 700 words.

Sounding Off

My first job as an engineering manager began in late 1969 at Bell & Howell Co. near Chicago. I was in charge of the electronics design for consumer- and professional-grade photo and audio products, which included cameras and projectors as well as tape recorders and other products. Innovation-minded economics guru Peter G. Peterson (who later became U.S. secretary of commerce and cofounder of the Blackstone Group) was CEO.

Mostly our photo competition was from Kodak and several emerging Japanese camera companies. With others in full control of the film, we had to rely on pluck and innovation to be competitive. One of our innovative products was the Filmosound 8 movie system for consumers. Before Kodak introduced Super 8 magnetic stripe film, there was no way for consumers to make movies with sound. To fill this need, Bell & Howell designed Filmosound 8, which consisted of a modified cassette tape recorder and special cameras and projectors.

One of the Filmosound 8 cameras, Model 1230.

During filming, the camera was connected to a tape recorder by a cable, and the user would make the many usual camera and recorder settings. One pulse per camera film frame was laid down on a cassette tape track next to the stereo sound tracks. During playback, the same recorder with cassette was connected to the projector via the cable. A pulse derived from each projector frame was compared with the pulse track on the tape to control the projector speed. Since this was a phase-controlled system, the cassette tape needed to be completely rewound in both record and playback modes to begin to synchronize properly. If the system ever got out of synch, there was no way to recover. Consumers Union tested Filmosound 8 and found that it was all a bit complicated for consumers. By today's standards, maybe not so much.

Before we could improve the synchronization issue, in the early 1970s, Kodak introduced Super 8 film with a magnetic stripe. Once again, we were scrambling for innovative features to keep our heads above water. Soon, consumer video came of age, and it was all over for consumer movies and the Bell & Howell consumer movie products.

James E. Beck, LM
Golf, IL

Innovation Times Two

I have had two original ideas of which I am immensely proud. The first has been called "modulation domain analysis" or "phase digitizing," although I did not coin either term. The idea was unrecognized before my use of it in the Hewlett-Packard 9540A transceiver test system. Period mode frequency counters had been used to measure the deviation of a frequency modulated waveform by capturing random period measurements and storing the high and low values. I wondered if it would be possible to capture a measurement of every period and thus to reconstruct a frequency modulated waveform in numerical form. I did exactly that in a test bed version of the HP9540A, using a pair of HP5326A frequency counters connected "back to back." One took a measurement while the other was being interrogated.

Since the HP9540A product only needed to measure repetitive waveforms, it used a single HP5326A to measure an odd number of alternate periods over two successive cycles of the modulation in such a way that the measurements could be interleaved to reconstruct the entire modulation waveform. This work was described in the August 1973 issue of the *Hewlett Packard Journal*. It was the basis for the HP5371A frequency and time interval analyzer, which appeared in 1988. Later, various vendors introduced related instruments.

My second idea was to use Fourier analysis to recover bearing-angle information from a very-high-frequency omni range (VOR) radio navigation signal. The VOR system is limited to an accuracy of a few degrees by its antennas and by the propagation characteristics of radio waves. However, it is desirable to check the calibration of VOR test equipment to a higher degree of accuracy.

I demonstrated that it is possible to achieve essentially arbitrary accuracies by taking enough samples of the waveforms with sufficient resolution. I showed that accuracies of millionths of a degree were possible—far beyond what is needed in any real-world application. This work was described in the *Journal of the Institute of Navigation* in the spring 1984 issue (vol. 31, no. 1).

Unfortunately, both of my ideas were conceived during the period when the United States Patent Office would not patent any idea that involved software. This position has of course been reversed but too late to do me any good. Now VOR is being augmented by GPS. But I have no complaint. I spent some 65 years working with electronics, and I earned a decent living and a comfortable retirement. And much of my work was very enjoyable.

Robert Gilchrist Huenemann, LM
Hollister, CA

An Old-Fashioned Assist

I had just finished my four years of active duty service in the U.S. Air Force, where I had picked up electronics as a possible career path, with an emphasis on auto-track radar systems. This was 1959, and jobs were available but not many in the electronics field for technicians. (I had not yet taken advantage of my GI Bill funds for an undergraduate program.) I was able to get a job with Vitro Weapons Services, a contractor supporting electronic testing at Eglin Air Force base in Ft. Walton, Florida.

I had good fortune in that the radar systems that were being used for test range support were the MSQ-1A auto-track systems that I had just finished work on as part of the 17th Tactical Missile Squadron in Taiwan. The support at Eglin Air Force Base seemed like an extension of what I had been doing for the past four years except the pay was a little better—only marginally!

The range support work included providing bomb scoring for Air Force bombers, fighter support for air-to-air combat scenarios, drone tracking, intercept tracking for ground-to-air missile systems, and other similar projects. It was the latter project that created the most interesting problem for the auto-track system.

There were four ground-to-air intercept missile systems being tested at Eglin, the BOMARC and the Ajax, Hercules, and Zeus family of interceptors. The range from the radar site to the BOMARC and the Ajax family was approximately 2,000 yd. The BOMARC lifted off the launch pad at a fairly mundane pace, allowing the auto-track radar system to respond to the rapidly changing elevation, azimuth, and range values without any problems. The BOMARC was powered by two rocket engines that burned red fuming nitric acid as a propellant and was relatively slow until it built up speed after launch. The Ajax family was a different sort of cat. The family used solid propellant rockets, and the launch rate was phenomenal—the auto-track systems response was simply too slow to respond before the rocket was gone.

The radar system had manual slew rates and other methods for the operators to attempt to track such fast moving targets, but they simply were not fast enough to track from the launch point. A solution was needed, and we had to go back in time and to another service for a solution. We found some old Navy telescopes mounted on a steerable pedestal. The pedestals were modified to include servo transmitters, which were then wired into the position controls of the radar. When the rockets were launched, an operator would manually track the rocket using the telescope, with the radar slaved to the tracker's position in elevation and azimuth (range changes were too rapid). When the radar operator determined that the radar had a solid track, the telescope system would be disconnected, and the missile tracked normally.

The moral to the story is that sometimes "old" methods can still provide modern solutions!

Ray Floyd, LSM
Cody, WY

The Legacy of Fort Monmouth

Fort Monmouth, New Jersey, the former home of the Army Signal Corps, closed down during the latter part of 2011. What seems to be missing is the story of its rich history of achievement and those who were instrumental in making such achievements possible. During and following the World War II years, the engineering portion of Fort Monmouth consisted of Evans Signal Lab outside of Belmar (where Marconi performed experiments), Coles Signal Lab outside of Red Bank, and the Squire Signal Lab and the Signal School on the main post. Gone are all of these activities, shrinking with the passage of time beginning in the 1930s just prior to WWII.

Looking back, Fort Monmouth led the development of radio and radar prior to and during WWII and on to Korea, continuing into the Cold War and Vietnam. In 1946, radar signals were bounced off of the moon using the Diana radar, which today is still housed at the Evans facility as a monument to this past accomplishment. In the late 1940s the Army at Fort Monmouth pursued the development of radiological detection including personnel-monitoring equipment. At that point in time, the Polaroid Land process was also considered as a potential radiological personnel monitor. Later came the Polaroid camera and Polaroid film. Fort Monmouth personnel were involved in the U.S. atomic testing program in the 1950s, both in Nevada and the Marshall Islands.

With the advent of transistors in the early 1950s, scientific personnel at the fort were instrumental in exploiting this new technology, the forerunner of today's microchips. Printed circuit production, as a means of miniaturization using discrete parts, was another fort achievement. In the years to follow, there were other developments including miniaturization, artillery, and mortar radar and frequency control devices (the basis of today's electronic watches).

Thus far I have been impersonal in my description of the fort. Names I remember, many of whom I had direct contact with, included Dr. Richard A. Weiss, who became chief scientist of the Army; Dr Harold Zahl, who invented the Zahl tube in WWII; Dr. Harold Jacobs, who had the vision of the flat-panel display (most of today's televison's are flat panel); Jack Eggert and Bud Waite, who made communications happen at the beachheads of WWII and beyond; Dr. Walter S. McAfee and the Diana radar; and Sal Petrillo, who headed the technical division at NATO, Paris, and Brussels. At least two IEEE Medal of Honor winners of the 21st century passed through Fort Monmouth for military obligations: Dr. Nick Holonyak and Dr. James Meindl. The Fort Monmouth Labs spawned many IEEE Fellows during its heyday. Many generations of Fort Monmouth personnel have served well in the research and development of electronic materiel for the armed forces of the United States and its allies. All of those scientists and their accomplishments must not be forgotten.

Bernard Reich, LF
Ocean, NJ

Automated Testing Ahead of Its Time

In the winter of 1968–1969, I was a field service representative for System Development Corporation installing the air defense system Back Up Interceptor Control (BUIC) III at Othello Air Force Station, Washington. BUIC was a back up for the better known Semi-Automatic Ground Environment (SAGE). The manned interceptor guidance test was very difficult because it required the "weapons controller" to take many actions at the console at very specific times for the test to work correctly. No previous BUIC III sites had passed the test; they had all received waivers due to the complexity and timing requirements of making the actions at the console. We, too, were having great difficulty completing the actions at the console at the required times to pass the test.

BUIC had an excellent simulation system for training. I suggested to my boss, David H. Payn, that I add the necessary weapons controller actions to the simulation (such actions were part of the simulation capability) so that they would be done accurately and at the required times. We had previously generated a simulation tape that displayed the simulated radar returns for the incoming airborne attackers. Dave allowed me to do that. The simulation system was very good in that it permitted a simulated action as well as an actual action during the same interval from the same console. This gave us opportunities to modify attack parameters on the fly, such as afterburner on/off on the manned interceptor and the attack approach (stern/beam/front). Other capabilities of BUIC were the recording of everything that happened and a data reduction of the recorded information or selected information. These capabilities provided times of all events that occurred. The automated Weapons Controller actions on the simulation tape showed that manned interceptor guidance was not working correctly. Dave had a team of specialists for the manned interceptor guidance program come to our site and use our simulation to see the problems. The automated test consistently ran the same test following the scripted times. With this tool, the specialists were able to see errors and fix the manned interceptor guidance program. With the corrected software, Othello Air Force Station was the first BUIC III site to pass the manned interceptor guidance test without a waiver.

On 12 January 2006, I attended a meeting of the Twin Cities (Minneapolis/St. Paul, Minnesota) Quality Assurance Association. One thing that the attendees hoped to do in the future was to have an automated test that allowed someone watching the test to override options in the automated test on the fly. BUIC III had that capability 35 years ahead of its time.

I have always been disappointed that, to my knowledge, System Development Corporation did not pick up on that early automated test on BUIC III to do more automated testing in BUIC, SAGE (which had similar simulation and recording/data reduction capability), and other systems.

Wayne D. Ward, SM
Rochester, MN

Transistor Design by Ear

My first major project as a fledgling electrical engineer involved the circuit design of a new electrically alterable, nondestructive readout, random access memory system. Reading or writing involved driving simultaneous current pulses down the row and column containing the selected memory word. The required current was over 1 A, and the reactance was such that it took about 40 V to achieve the required submicrosecond rise and fall times. At that time there were very few transistors that could meet the challenge. One that did, at least on paper, exhibited unusually high failure rates. The phenomenon known as "second breakdown" was widely, and quite reasonably, assumed to be the cause. Circuit tweaks were applied to minimize, within application requirements, the exposure to second breakdown conditions. However, this did not entirely solve the high failure rate problem, and more drastic modifications such as splitting the load among multiple transistors were being contemplated.

Circuit design responsibility, as practiced in that project, included software design to allow for fail-safe operation and remote diagnostic access. I had written such software for this memory system and was quite familiar with the exercises that cycled through the entire system searching for errors or out-of-limit conditions. One day, in the lab, with exercises running, I noticed a high-frequency sound, not unlike the flyback whistle you may have heard from loose hardware on your old television receiver. Except this sound was pulsating, and pulsating at a rhythm suspiciously like the access cadence of a memory exercise. Eureka!

At the next opportunity, I took a hacksaw to the power transistor cases on a failed access switch card. The stitch-bond wire from the collector pad to the header had failed to open, just as it might if the collector-emitter short of second breakdown had drawn excessive current. But, aside from the open stitch-bond, the transistor chip was still perfectly good. After opening several failed access switch transistors and discovering collector stitch-bond wire failure in every one, I was ready to announce my diagnosis: the Faraday force generated by the surge of access current was physically causing the fine stitch-bond wire to flex (hence, the sound that I noticed), and repeated flexure was weakening the wire to the point of failure.

Though well outside my bailiwick, the transistor design was modified to double stitch-bond the collector, and both the memory system and many other projects using that same power transistor went on to perform very reliable thereafter.

Randolph S. Little, LSM
Basking Ridge, NJ

The Phantom of the Runway

In 1973, as a soon-to-be Ph.D. in electrical engineering, I received a job offer from Sperry Flight Systems in Phoenix, Arizona. Along with Grumman Aerospace Corporation, Sperry had received a NASA contract for an airborne simulator to train astronaut-pilots for Space Shuttle landings. Having majored in digital systems, I eagerly accepted and joined the Shuttle Training Aircraft (STA) team.

Grumman provided a Gulfstream II executive jet with additional control surfaces for direct lift, side forces, and, most importantly, drag to increase the normal glide slope to the much steeper descent of the Space Shuttle.

Sperry provided an advanced digital control system that received inputs from the cockpit controls and sent commands to the control surfaces to emulate the expected behavior of the Shuttle. Following construction and qualification of the airborne control system, I traveled to Bethpage, New York, for the aircraft modifications and systems integration and then to Calverton, New York, for the flight tests. Those were exciting experiences for the young engineers in our group—especially when the NASA astronauts joined the team.

I was one of two Sperry engineers supporting flight testing when the first hands-free landing was attempted. Since I was primarily a systems integrator and my teammate was more involved in the guidance software, he was chosen to attend the preflight planning with the pilots and flight controllers. Of course, this first "landing" would not take the STA anywhere near a real runway. Due to the steep descent—with thrust reversers deployed and landing gear extended—a phantom runway was defined safely above the Long Island Sound.

Warford visited the Texas Air and Space Museum in Amarillo for a reunion with the NASA Shuttle Training Aircraft that was retired following the closing of the Shuttle program.

My teammate came back from the meeting with the coordinates of the phantom runway and promptly programmed them into the control system. Once the STA was airborne, the flight controller directed the STA to a location near the phantom runway where the pilots activated the digital control system and settled in for the ride. The objective of the Terminal Area Energy Management (TAEM) software was to manage the kinetic and potential energy of the STA so it reached the runway threshold at the right altitude and speed for the landing. To achieve this goal, the TAEM algorithm calls for alternating left and right banking turns to bleed off energy as the STA approaches the runway threshold.

The first landing attempt was scripted to commence with a favorable alignment of aircraft and runway, so everyone was quite surprised—especially the pilots—when the STA banked to the maximum angle of 45° as soon as the control system was activated. A quick response from the pilots disengaged the computer and returned the STA to a more normal attitude. A repeat of the test produced identical results, and the flight was terminated with a debriefing to follow.

Once again, my teammate joined the pilots and flight controllers. It did not take long to discover the problem. Two potential phantom runways had been discussed at the preflight meeting and the flight controllers left with one set of coordinates while my teammate left with the other set. The flight controller had vectored the STA for one site, and the computer attempted to land at the other!

Thanks to the experienced pilots, safety procedures built into the flight test program, and the digital control system, no harm resulted from the miscommunication.

That first STA and its three siblings have earned the praise of every Shuttle pilot since the inception of the program over 30 years ago, with each one performing hundreds of practice landings at the controls of the STA before getting the "keys to the Shuttle."

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Submitting Articles

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 1 April 2015. 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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