THE BRIDGE
The Magazine of Eta Kappa Nu

FEATURES

The Challenge of Change: Reflections of an Engineer

Leadership for the Information Renaissance

What Do Changes in the ECE Profession Tell Us about ECE Education?

Broadband over Power Lines

www.hkn.org
Dear HKN members,

As your term as president of HKN comes to a close, I am most pleased to acknowledge the tremendous support that I have received from so many in the HKN family. We have tried our best to accomplish many things that we believe will move the association forward, and it is only through the efforts of our volunteers and staff that we have collectively made what we hope will be significant steps in that direction.

We have now arranged to have the IEEE Board of Governors' biennial meetings in conjunction with the annual meetings of the Electrical and Computer Engineering Department Heads Association (ECEDA) and the President in Education (FIEP) Conference, co-sponsored by IEEE and the American Society for Engineering Education (ASEE). Furthermore, an HKN update is a regular item on the FIEP/ECEDA business meeting agendas, and each meeting has become a venue for specific HKN annual awards. Thus, our association is closely connected with two critical communities. Also, by meeting in conjunction with larger groups that already have hotel discounters, we are able to save money.

We have also arranged to have, when appropriate, the Encomiunt Member awards presented at the IEEE Biennial Convention each year. This is a very elegant affair with the winners and Board in formal attire, and the presentation of the Encomiunt Members from around the world to attend the convention of HKN.

Finally, the HKN officers and Board of Governors have worked in cooperation with IEEE officials to achieve a merger of the two organizations through a memorandum of understanding. The merger with IEEE would do the following:

- Guarantee that the HKN name will be perpetuated for all time.
- Give HKN a permanent corporate home.
- Provide a much-needed infusion of cash into HKN to enable us to permanently endow awards, increase support for chapter activities, assure that we can have a multi-chapter conference each year, and enable many other worthwhile projects.
- Allow IEEE to apply for grants for special projects from the IEEE Foundation and from the IEEE Life Member Fund. These grants would support special projects such as a theme meeting of HKN chapters on a specific technical area or a geographical get-together of HKN members from a particular region.
- Give HKN access to the 1,500 IEEE branches worldwide so that we can globalize the HKN name in 150 countries with IEEE chapters in every country. This is another value enhancement for membership in HKN because as the world increases on the path of globalization, recognition of the HKN brand to people outside the United States is imperative.
- Enhance the value of membership in HKN by an extensive worldwide public relations effort entailing the value of prestige of being an HKN member.
- Give HKN access to IEEE fundraisers to enable us to have both broad-based and targeted fundraising campaigns to further increase the HKN endowment.
- Give HKN access to IEEE's institutional Advancement to train us in writing proposals to Foundations, governments, and NGOs, allow personal synergies with the publication of THE BRIDGE, for example, the use of IEEE-sponsored technical papers, etc.
- Give HKN access to IEEE's electronic database of 570,000 IEEE members, many of whom see HKN members, to allow us to improve communications with HKN members and facilitate the operations of HKN.

And the last part—all of this can be done with no increase in the subscription fee (since the subscription of money from IEEE will come permanently any extra cost), on change in chapter activities (every HKN chapter can continue to operate just as they do now), or change in the academic requirements for HKN membership, and full authority to the IEEE Board of Governors for all awards, programs, and requirements.

I am most thankful for the opportunity to work with such a wonderful group of professionals during my term as president. It has been my honor and privilege to work with the Executive Committee members Karl Mertenkerk and Bruce Flanagan, our Board of Governors—Stephen Goodick, Budge Hirt, John Orr, Terence Pust, Castro Spyroukas, and David Saldan; a superior staff composed of Roger Plummer, Kathy Hickam, Allison Miller, and Barry Sullivan; our IEEE chapter charter, and our IEEE colleagues, Dr. Monte Karm, to admit and essentially single-handedly achieve the support of the IEEE for the merger, and Pern Kastenschmidt, our IEEE liaison. Finally, I look forward to supporting Bruce Flanagan, a former president of IEEE, as he works to bring HKN to an even higher level of service to the members, to society, and to the profession.

Warm regards,

President

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P.S. The Office of the President of HKN is located at the University of Illinois.

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Etu Kappa Nu
The Electrical and Computer Engineering Honor Society
Founded October 28, 1904

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THE-BRIDGE
The Magazine of Etu Kappa Nu

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Spring 2008

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Etu Kappa Nu (HKN) was founded by Maurice L. Corr at the University of Illinois on October 28, 1904, to encourage excellence in education for the benefit of the public. HKN's focus is on recognizing those students and professionals who have conferred honor upon engineering education through distinguished scholarship, activities, leadership, and exemplary character as students in electrical or computer engineering or by their professional achievements. THE BRIDGE is the official publication of the Etu Kappa Nu Association.

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2007 Student Leadership Conferences

After months of planning, two chapters, University of California, Berkeley, and Gamma Theta chapter, Missouri University of Science and Technology (formerly the University of Missouri, Rolla), hosted the annual student leadership conferences in October and November 2007, respectively.

Both host chapters were repeat Outstanding Chapter award winners that organizes the themes, speakers, sponsorships, and facility for each two-day event. Student conference chairs from each chapter learned valuable insights on leadership and project management, and the organizing committees proved that teamwork is imperative in hosting a successful event.

Chapters from five states were represented at the University of California, Berkeley for “Making a Difference: Leadership through Innovation.” Guest speakers included professionals from Mellwater Group, Next Development Group, Virginia State University, and the University of California, Berkeley. All are making significant impacts in industry, and their thought-provoking addresses gave insight into the continuous advances in technology and future opportunities for student and young professional HKN members.

At the Missouri University of Science and Technology, the following weekend, students from nine chapters gathered for “Leadership for a New Century” and shared insights on chapter development, communication with alumni, and leadership skills. Guest speakers from BIM and Melwater, Dynetics, IEEE, Affirm, and Potomac magazine stressed the importance of lifelong learning. Professionals must learn to adapt to the changes surrounding them, and there are many opportunities for HKN professionals to be on the leading edge of these developments.

HKN is pleased to offer these leadership development opportunities for student members and appreciates the support of generous alumni and corporate partners. More conference information, including the agenda, session summaries, and future conference opportunities, are available on-line (www.hkn.org).

2007 Student Leadership Conference Sponsors
University of California, Berkeley • Next Development Group • Mellwater Group • Informatics • Missouri University of Science and Technology • Gamma • Affirm • Dynetics • BIM • Dickinson

www.hkn.org
The Challenge of Change: Reflections of an Engineer

by Irwin Jacobs

I entered MIT as a graduate student planning to study electromagnetic theory and antennas. However, I joined a group of faculty and students led by Professor Claude Shannon, the father of information theory, and decided that digital communications would be my future. And I'm very pleased with that decision.

Teaching Change

After completing a thesis on network reliability, I joined the faculty at MIT. Professor Jack Wnorowski and I created a new senior course on communications focused on the theory and potential applications of probability and information theory. We edited the class notes as a textbook Principles of Communication Engineering, published in 1965 and still in use.

In 1965-66, while completing my thesis, I took a leave of absence as a NASA research fellow at JPL in California. Just after returning to Boston, Professor Henry Booker, from whom I learned electromagnetic theory at Cornell, called and invited me to help start electrical engineering at a new university in San Diego. The first reactions of my will, fear, and myself to this change was no. But after two days, we reconsidered and decided that moving to California and joining a new public university, the University of California at San Diego (UCSD), was an exciting opportunity and we accepted. I enjoyed helping shape the new curriculum. One of the undergraduate classes I started was an introduction to computers. It attracted engineering students, of course, but also students and faculty from the music and art departments who wanted to learn about changes possible with digital technology. These contacts have had a lasting impact on my own interests.

A Change in Career

The move to California led to another major change in my life. With my MIT background and background in digital communications, I had many more requests for consulting from the aerospace industry in Southern California than I had time to support. After mentioning that to a couple of UCLA faculty friends, they suggested we start a company and share the consulting. So we started a company called Linkabit. Very quickly, it began to grow. I took leave from 1969 to organize and direct the company to 1971, found it great fun, and became an "academic dropout" in 1972 after accumulating years in a professor. In addition to the technical challenges, I had to master financial and marketing areas. Luckily I had taken courses in accounting and business law in the hotel school, but I also found that engineering provided an excellent preparation for most areas of business.

We made the "mistake" of selling Linkabit in 1980, and in 1981 I retired after leading the development of an exciting range of innovative products, including satellite-to-home TV and business satellite communications terminals supporting Wal-Mart, among others. Retirement was OK for three months, but I was then ready for another change. After marrying Joan then, even if things went very well, we might grow to 10 employees, I started Qualcomm with six others from Linkabit. We're now over 12,000 employees.

A Business Built on Change

Initially, we didn't have a business plan or any products, but we did know that digital and wireless would be very exciting. Shortly after starting, during a drive from Los Angeles to San Diego following a consulting meeting on mobile satellite communications, I realized the potential value for mobile communications of code-division multiple access (CDMA), a subject previously of military and theoretical interest. We had to work until November 1986 before we could devise the resources to develop the idea. At that time, we signed a contract to install our first major product, DirectTRACS, on a fleet of 5,000 trucks, generating the needed cash flow.

Ocasionally when you are in business, you have to make a bet-the-company decision. CDMA was one. Should we commit a bit of money to R&D in a technology that may or may not be accepted? Is the world going off in a different direction? Luckily at that time, I had not heard one of the projections that had been made. We just coerced a few years earlier predicting 500,000 cell phone subscribers by the year 2000 (actually, there were 10 million). We did develop the technology and demonstrated in November 1989 that we had solved the problems that led others to say that CDMA would not be commercially competitive. Then the question came up, if you have a good product, how do you build a business model? We decided in both learn the technology broadly, using an open license fee to support continued R&D plus royalties if successful, and supply chips, phones, and infrastructure to ensure equipment availability. We later sold the phone and infrastructure manufacturing businesses while continuing to supply chips.

Today, there are more than three billion cell phones in use around the world, with more than one billion sold per year. Qualcomm is now the largest supplier of chips for cell phones.

It's quite clear that the future is not in plastics, but in mobile devices.

Changes Ahead

When we built our first CDMA cell phone, it took three chips to implement just the communications. Now, communications, including not just voice, but also high-speed data, includes about 20 percent of one chip. What do you do with the other 80 percent? You provide computing power comparable to a supercomputer of a decade ago plus camera, 3D graphics, video, and global positioning.

Conclusion

So, changes continue at an ever-increasing pace. With a strong education and an openness to new ideas, one can take advantage of and shape these changes. I wish today's students as much fun and excitement as I have had along the way.

ABOUT THE AUTHOR

Irwin M. Jacobs
Co-Founder and Chairman of the Board of Directors, Qualcomm Incorporated
Kapetsky chapter – Cornell University

Dr. Jacobs has led the commercialization of semiconductor technology and its success as the world's largest, fastest-growing, most-adaptable and most-widespread communications technologies. From 1979 to 1986, Dr. Jacobs was an associate professor of electrical engineering at the Massachusetts Institute of Technology. From 1986 to 1972, he served as a professor of computer science and engineering at the University of California, San Diego. At MIT, Dr. Jacobs was an associate professor of Communication Engineering. First published in 1990, the book remains in its today. Dr. Jacobs is an Eminent Member of the National Academy of Engineering.
Vladimir Karapetoff Outstanding Technical Achievement Award

This award is given annually to an electrical engineering practitioner who has distinguished himself or herself through an invention, development, or discovery in the field of electrolytechnology resulting in significant benefits to mankind.

AWARD WINNER

Presented March 2008

Arun G. Phadke

As modern civilization has grown more dependent on electric power, the need to maintain a reliable and secure power grid has become imperative. Arun Phadke has helped meet this imperative by creating tools for grid-wide measurements and a methodology to act on these measurements quickly, leading to dramatically improved power reliability and security. He pioneered the development of hardware and software that led to widespread industry use of computer-based relays—the devices used to monitor and protect the power grid. Dr. Phadke spent the first thirteen years of his career working in the electric utility industry before joining Virginia Tech in 1982. He served as the American Electric Power Professor of electrical engineering and was recognized as a University Distinguished Professor. He retired in 2000 but continues as a research faculty member of the electrical and computer engineering department of Virginia Tech.

Stanley H. Horowitz

For people understanding the relationship between knowledge and power better than Stanley Horowitz. An author, consultant, lecturer and engineer, he has guided policy and educated himself and others on safe and robust power distribution for more than 50 years. He began his career in 1958 at the American Electric Power Service Corp. (formerly the American Gas and Electric) and retired in 1989, having served as head of the system protection section, assistant head of the electrical engineering division and as a consulting electrical engineer. A fellow of the IEEE, Horowitz served as chairman of the IEEE Power and Engineering Society’s (PES) Power System Relaying Committee from 1975 to 1978; was a member of the PES executive board, the Life Member Committee, the PES Fellows Committee and a chairman of the PES Constitution and Bylaws Committee.

Phadke at a Glance

- University Distinguished Professor Emeritus, Virginia Polytechnic Institute and State University
- American Electric Power Professor (1985-2000)
- B.S. from Agra University, B.T. from Indian Institute of Technology, Kharagpur, MSIEE from Illinois Institute of Technology, and Ph.D. from University of Wisconsin-Madison

Horowitz at a Glance

- University Distinguished Professor Emeritus, Virginia Polytechnic Institute and State University
- American Electric Power Professor (1985-2000)
- B.S. from City College of New York; attended Brooklyn Polytechnic Institute Graduate School, and the University of Michigan Graduate School of Business

THE•BRIDGE

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Be a Contributor (and It Won’t Cost a Thing!)

Got something to share? We are seeking articles from members at all levels for future issues of THE BRIDGE. Whether you are already a published author or you still wonder what it’s like to see your words in print, we invite you to submit an article for consideration.

Topics can include—but are not limited to—technical perspectives (past, present, and future), first-person experiences, career issues, and observations on industry and the profession.

Articles for THE BRIDGE are 1,000–1,200 words in length and can include up to two figures (photos, graphs, or other images). Manuscripts should be sent in electronic form via e-mail to editor@bkb.org (MS Word .doc files preferred).

Share Your Wisdom

This issue of THE BRIDGE includes Member Profiles, an opportunity for members who are established in their careers to share the wisdom gained from experience with younger members.

Members interested in contributing to this feature should send a 100-word career synopsis via e-mail to editor@bkb.org. If selected, we will ask for your responses to a set of interview questions addressing your educational and career experience and your advice to young engineers.
Leadership for the Information Renaissance: Success for Individuals and Organizations

by Jay E. Gillette

It was the European Renaissance that forwarded the concept of this multidimensional era. My hypothesis is that the demands of our Renaissance age require them to develop the type. How do we translate the European renaissance person ideal into a practical application of the information renaissance?

By way of conclusion, I put it this way: be a "T"-person—a person whose structure of personality and attributes resembles the structure of the letter "T." Be both broadly comprehensive (the T-atop) and deeply competent (the T-base) as one complete person. In essence, the information renaissance person has and displays breadth and depth; breadth of comprehension (the goal of liberal arts education) and depth of competence (the goal of professional education).

These foundational personal and educational attributes lead to professional behaviors we value in the professional world—adaptability and utility. Breadth leads to adaptability to succeed in rapid change (adaptability to environment); depth leads to utility to prosper by adding value (find a need and fill it).

Succeed as a Person — Become a Renaissance Man or Renaissance Woman

According to the Merriam-Webster's Dictionary, 10th edition, the phrase "renaissance man" is "a person who has wide interests and is expert in several areas." Indeed a good undergraduate education on the classic liberal arts model works to build such a person at a young age. The idea is that the graduate will continue a lifelong learning enterprise along the same lines. Yet professional specialization and the current demands of an overcrowded marketplace cleary obstruct the means to that end.

Creative Power You Can Access — Information is a Set of Ideas You Use

"If information is based on ideas—ever that you use—are there two key parts to that thought. First, the obvious place to focus on is the "news." That is the "outside" part of the thought. The data comes from the outside. Yet, what turns data into information is that you bring inside the "outside" news to you. You bring the data into your own head, your own mind or consciousness.

That is what makes it "information" for you. Recall that the Latin prefix "in" means "in," the name as in English, "form" means form, or shape. So when you are informed, ideas or data take from or shape in your mind.

Today, information and communication technologies are being called ICT as an acronym. The acronym "ICT" is reflecting the older, more limited acronym "IT" that came from the computer industry, which stands for "information technology," essentially computers and peripheral devices such as printers, storage devices, and, later, data networking and voice together with wireless radio transmission.

The newer acronym ICT gives a broader sense of telephone, television, video camera, multimodal, and other devices while including computers and music players and the transmission media, short range or long.

The main point, however, is that all these devices are ways to communicate information, so we will focus on information and communication, not on technologies. Think of the technologies as tools and enablers for us to better manage our information and communicate together more effectively.

Conclusion

The key thought is these are not mysterious new areas of human knowledge and work, instead, these are areas we already have worked for a long time. We must train, educate, and discipline in these areas, We need to improve these areas. Yet as I have argued, we need to look at these areas in a new way. We need to reframe what we need to know now. We are already participants in today's information renaissance.
Outstanding Chapter Award Winners

2006–2007

Twenty chapters were recognized at the 2006 Annual ECEWeek and HKN Awards Banquet March 17, 2006, in San Diego, California, as 2006–2007 Outstanding Chapter Award Winners. This prestigious award was presented to the department head of each chapter in a private reception with the HKN Board of Governors and special guests in attendance. Allen Lefkow, HKN Outstanding Chapter Award Committee chair, presented the plaques with Dr. Dave Travis, HKN president.

The award is based on the personal-hours of service, leading the playing field for large and small chapters to be recognized. Other considerations for the award include recruitment and service activities to the department, university, and community. Nominations are taken from the required Annual Chapter Report, due October 15 for the previous academic year. Award details are available on the HKN Web site (www.hkn.org).

2006–2007 CHAPTER AWARD RECIPIENTS

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Notes from Headquarters

As we close another academic year, HQ has a few important notes:

- Don’t forget to update your contact information online!
- Student members should save November 7-9, 2008 for the 2008 Student Leadership Conference at Carnegie Mellon University. Check online for details.
- Chapters are required to file either a 990 or e-postcard (990E) with the IRS starting with the fiscal year ending June 30, 2008. Please keep track of your finances carefully. Details will be provided to faculty advisors after July 1 for the proper filing procedures.
- Verify that your membership records have been sent to HQ. Inductees are NOT considered members of HKN until HQ has received the complete paperwork and dues and they will not have access to MEMS RUS magazine, Experience, Inc., or other HKN member benefits.
- HKN has recently partnered with Experience, Inc., a career services and alumni networking community. Registration is free and provides many opportunities for interacting with professional HKN members, free member to member job posting, and tens of open jobs and internships both in and out of ECE.
- Annual Chapter Reports are due October 15, 2008 for the 2007-2008 academic year. Chapter officers, please work with your incoming officers to be sure this project is completed on time. The chapter report is used to determine the Outstanding Chapter Award winners so go the extra mile and include pictures and detailed descriptions of your activities.
- Nominations for the Outstanding ECE Student Award are due June 30, 2008 for a graduating senior. Chapters are encouraged to nominate their top student for national recognition and a financial award.

As always, the HKN Web site (www.hkn.org) is the best source of information, paperwork, project ideas, award information, and upcoming activities.

HKN Chapter Highlights

In addition to their impressive scholarship abilities, HKN members are dedicated to performing service activities and having some fun too. The following is a glimpse into only some of the impressive projects going on around the country.

Pumpkin Pl – For each ticket pledged sold, a small pumpkin with one of the digits of pi is added to the ECE lobby. By Halloween numerous pumpkins line the hallways and a pumpkin pie is raffleed off to the winning ticket holder. Best of all, the proceeds are donated to a local shelter for victims of domestic violence.

Elementary After-School Programs – HKN members volunteer at an elementary after-school program making crafty Valentine’s Day cards.

CoE Junior Expo – HKN helps promote the College of Engineering by hosting intermediate school students in competitions for various engineering fields, including an electromagnetics fishing pole competition. HKN and IEEE chapters combine efforts in introducing basic engineering concepts and getting younger students interested in the exciting fields of ECE.

Arb Day – HKN members get out of the lab and get dirty in a local nature preserve. Environmentally considerate and always eager to expand their knowledge, they learn about invasive species and preserving the local ecosystem. Armed with hack saws, they fell trees and collect seeds of the native plants to plant elsewhere.

Scholarships – HKN members started the Laboratory Supplies Project years ago with two goals in mind—to raise money to fund an HKN scholarship and to provide savings to students on required lab equipment purchases by purchasing in bulk. The proceeds from this project and generous alumni donations have raised enough money to establish the ECE HKN Endowed Scholarship at Georgia Tech and guarantee the scholarship in perpetuity.

Social – HKN members also like to have fun! Picnics, Whirley Balls, paintball, bowling, dance lessons, movie nights, pizza parties, HKN versus IEEE football and soccer tournaments, barbecues, video game tournaments, and trivia competitions are only some of the ways HKN members spend those rare study breaks.
What Do Changes in the ECE Profession Tell Us about ECE Education?

by John Orr

path of an aircraft. We pushed that approach a very long way while also developing three new branches of our profession—signal and systems analysis, digital communication, and solid-state devices. The synergy of these three areas, building on the incredible simplicity and elegance of systems such as the telephone, AM radio, and the power grid, have brought us to the present day, where most electrical and computer engineers could not recall when they last made use of classical circuit theory.

As we look at ECE over the past 40+ years in the United States, we see several trends: general, industrial, and professional cycles play out. We see these cycles in the names of companies that have come and gone or transformed themselves: Radio Corporation of America (RCA), General Electric, Westinghouse, American Telephone and Telegraph (AT&T), Bell Telephone, International Business Machines (IBM), Digital Equipment Corporation, Hewlett-Packard, etc. The profession moved from dominance on the power side to analog electronics with the growth of communications and entertainment networks, to digital computers, to the networking explosion. At the same time our profession was maturing and moving from being almost purely technology-driven to being predominantly market-driven.

Where We Are Today

In other words, we moved from “What can we do technically?” to “What do people want and need to have done?” In fact, this transformation was already underway when I began my ECE career with Bell Labs in 1969. I worked on the “Phototube” project that represented a natural enhancement of telephone service to include a full-motion image of the person to whom you were talking. We were extremely proud of our ability to transmit and switch 1 MHz bandwidth analog video using upgraded telephone technology, but it turned out the customers did not buy the service. It simply did not have value for them. That was humiliating for the Bell System!

On another front, our profession moved from being highly concentrated geographically, often around universities in the United States and a few other highly developed nations, to its current status as a truly global profession. With this maturation and broadening, the profession in the United States is really different than it was a generation ago, and the profession in some other nations may be quite similar to the situation in the United States in 10, 20, or 30 years ago. In particular, the part of engineering that we think of as heart, analog and digital design engineering, is completely global in scope, and probably shrinking in size as a proportion of the overall profession. Conversely, the part of engineering that are closer to the customer are location-dependent and are growing. Because of our great technical successes and our ability to build on past work to design systems of ever greater complexity, in ECE we can now do almost anything. The important question is “What should we do?” Only our customers can answer that, and it is the customers who drive the entire enterprise.

Looking Ahead

Hence for the United States at least, our view of ECE should be more systems-oriented, more focused on innovation and on customers. This has a substantial impact on the undergraduate ECE curriculum. We can in fact, invert much of the curriculum. That is, we can move much of what used to be considered basic and core courses to the senior or graduate level. This includes topics as circuits and networks beyond the most elementary. A particularly significant example is solid-state physics. Long ago this was considered an advanced topic, suitable only for graduate school.

When I entered college, solid-state theory was being introduced into the undergraduate curriculum because the future of electronics was clearly based on the transistor and we needed to understand the fundamentals of transistor operation. Now solid-state electronics, both analog and digital, is so highly developed that most engineers make use of functional building blocks only and few actually design those circuits at the device level. Hence, any in-depth study of solid-state theory can once again be left for graduate school, for those relatively few engineers who will pursue that specialty.

Our goal should be to develop an undergraduate ECE curriculum that can be completed in four years even if the student enters college without having chosen ECE as a his/her intended major. I believe this is essential if we are to make more programs on our long-sought goal to substantially increase participation by women and under-represented groups, as well as to make the program attractive to more of our traditional students. To accomplish this, we will rely more on master’s programs to supply the domain-specific knowledge that many engineers will need. At that point (rather than fresh out of high school) the engineer is in a position to make informed choices about his/her advanced education, just in the building ladder or doctor to be able to make choices about his/her professional education.

As members of the Kappa Nu, we are expected to be leaders of our profession. In order to lead we must have a clear vision for what the ECE profession is, and most important, what it will be in the future. On a global basis ECE is a major player in raising the standard of living in many nations, and it is doing that in two distinct ways: first, by bringing affordable technological products to people of very modest means; second, by enabling the growth of high-tech industries that build those products locally and put people to work in relatively high-paying jobs. Within the United States the profession is evolving and maturing in the ways described above. As industry leaders many of you will play on both stages—participating in the global economy and making decisions that will determine our profession’s future in the United States.

Conclusion

Three aspects are key:
1) Continue to focus on the technologi
cal breakthroughs and innovation that we do so well.
2) Pay close attention to our customers
and their varied needs.
3) Help us move to an ECE educational
approach for which many large blocks of
bright high school graduates say “That’s what I want to study
in college.”

For more on this topic, visit
www.hkn.org/bridge

ABOUT THE AUTHOR

John O. Orr

Professor and Interim, Dean of Undergraduate Studies, Professor of Electrical and Computer Engineering, Worcester Polytechnic Institute

Dr. Orr earned his B.E. in 1977 and served as head of the Electrical and Computer Engineering Department from 1998 to 2003. In addition to his B.S. and Ph.D. degrees from the University of Illinois, he received the M.S. degree in EE from Stanford University. Dr. Orr’s research includes recent work in the area of positioning systems, and he is currently interested in signal processing applied to power systems. He has also been involved in curriculum development as both the undergraduate and graduate levels as well as in assessment and accreditation activities for engineering education.

Dr. Orr serves as chairman of the Kappa Nu and is a fellow of the IEEE.

www.hkn.org
The Synplify DSP product from Synplify is an ESL synthesis solution that offers a fast, efficient way to implement DSP algorithms in FPGAs or ASICs. By automating architectural optimizations like pipelining, resource sharing, and multi-channelization, engineers can save months of RTL coding, simplify design capture, speed up verification, and create technology-independent IP.

Synplify offers accredited universities industry-leading commercial software solutions including Synplify DSP. For more information please visit www.synplify.com/ university.html or university@synplify.com.

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**Outstanding Electrical and Computer Engineering Student Award**

The Allen B. Zehby and Carl T. Keumer Outstanding Electrical and Computer Engineering Student Award recognizes outstanding scholastic excellence and high moral character, coupled with demonstrated exemplary service to classmates, university, community, and country.

This program is administered by the Los Angeles Area Alumni chapter. A jury of distinguished engineers selects the recipients.

For more on the award and a list of past winners, visit www.hkn.org/awards/oecces.html

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**2007 AWARD RECIPIENT**

Piyal Chandrasakar, University of Maine

At the annual meeting of the Electrical and Computer Engineering Department Honors Association (ECEHonA) March 17, 2008 in San Diego, California, Piyal Chandrasakar accepted his 2007 Outstanding ECE Student Award plaque and increased gift from Tom Roebuck, Award Committee chair, and Dan Dan Zvika, HKN president, in front of 566 guests at an annual HKN and ECEHonA Awards Banquet.

Piyal is double major in electrical engineering and economics at the University of Maine in 2007 and currently studies at the University of Cambridge in England. At UMaine, Piyal was an officer in the Key Club, NISEE, Golden Key Honor Society, and a member of Phi Deta Pi, PiSigma, and the National Society of Collegiate Scholars. For two years played cricket with the UMaine Cricket Club and participated in the International Students Association, the Black Bear Men’s Chorus, and UMaine Pep Band.

Piyal’s peers awarded him Resident Advisor of the Year, President of the UMaine Student Government, Student Leader of the Year, and Outstanding Freshman, Sophomore, Junior, and Senior. Piyal still manages to maintain a high grade-point average and volunteer his time at the Crescent Model and Women’s Soup Kitchen. He was also chief of the successful campus-wide events such Metal Chef 2006, Raquette 2005, International Dance Festival 2005 and 2006, and Kumbh March 2003 and 2005.

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**Honorable Mention:**

Rahul D. Jagani, University of Mيون - Urbana-Champaign

Monte K. Watanabe, University of Malaya - Malaysia

Finalist:

Minh-Jay Shin, University of Delaware - Urbana-Champaign

Kristine Skimmer, University of Southern California

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2008 Student Leadership Conference

HKN is pleased to announce that Sigma chapter, Carnegie Mellon University, will be hosting the 2008 Student Leadership Conference in Pittsburgh, Pennsylvania, November 7-9, 2008, entitled "Technical Leadership and Innovation.

Mark your calendars! This year’s event will have the added feature of a student congress to discuss with the HKN Board of Governors the future of HKN and life after the potential merger with the IEEE.

The conference will begin Friday evening with an informal gathering for students from across the country to interact and socialize. Saturday the conference will feature world-renowned speakers, panel discussions, topical break-out sessions, and special activities, including a trolley tour of Pittsburgh. Saturday will conclude with a special keynote dinner.

Sunday morning everyone will gather again for a special congress to discuss the future of HKN. This is the ideal opportunity for chapters to provide direct feedback to the HKN Board of Governors regarding what they would like to see offered from the honor society, what they appreciate about being a member of HKN, and how to continue to serve the membership from the time they are induced as students throughout their professional careers. The board believes that the merger with the IEEE will not affect the daily administration of HKN, but it will provide opportunities for expansion, industrial interactions, and funding that will ensure HKN’s existence as the premier electrical and computer engineering honor society for many years to come. The board of governors is interested in student input and appreciates Sigma chapter offering to facilitate this special event. All chapters are invited to attend, and HKN is currently seeking financial support for chapters to attend. More details about the conference and possible travel stipends will be sent to the chapters and will be available on the HKN Web site (www.hkn.org).

If your company is interested in sponsorship opportunities, please contact Melissa Miller at HQ (amflour@hkn.org) for more information.

We look forward to seeing you in Pittsburgh in November!
Transmission substations next to power plants use large transformers to step up generator output from thousands of volts to hundreds of thousands of volts (typically between 155,000 and 765,000 volts), thus allowing megawatts of power transmission over distances of 500 miles or more.

At power substations, voltages are stepped down and lines are branched out to cover larger areas. This is performed successively, transforming and branching out from extremely high voltage (EHV) typically 155 to 765 kV to high voltage (HV) typically 45 to 155 kV, and from HV to medium voltage (MV) typically 2 to 45 kV, and finally from MV to low voltage (LV), typically 100 to 600 V for delivery to homes or businesses. The result is a tree-structured power distribution hierarchy. Basicly, HV and MV are used to transmit AC electric power, and MV and LV are used to distribute it.

A network of MV lines is usually referred to as the primary distribution; a network of LV lines is the secondary distribution. In the United States, at the primary distribution level, most power lines are aerial, or overhead. At the secondary distribution level, particularly in newer urban areas, most lines run underground. Overhead lines are less susceptible to producing radiation interference and picking up interference than underground lines. But underground lines are used less due to the prohibitive cost of burying cables. In the United States, MV lines typically run between 15 and 50 km.

**Altering the Power Grid to Allow BPL**

BHV and MV lines are usually too noisy to transmit broadband communications signals; only MV and LV lines are used for BPL. MV lines are usually less branched than LV lines, making point-to-point connections possible. MV networks become communication over longer distances because of their weaker signal attenuation and lower noise level. To use power lines for broadband communications, the broadband signal must be injected into and extracted from the lines through couplers. LV couplers may be capacitive or inductive, depending on distribution system topology, performance requirements, and cost. In capacitive coupling, a capacitor is responsible for the actual coupling, and the signal is modulated onto the network's voltage waveform. In inductive coupling, an inductor is used to couple the signal onto the network's current waveform. Inductive couplers are known to be more long, but since they require no physical connection to the network, they are easier to install on energized lines than are capacitive couplers. LV couplers are typically inductive.

It is important that couplers be easy to install and passive devices with low failure rates that can be used outdoors and installed on energized lines. Line noise, limitations on the amount of signal power that can be injected into power lines without causing unacceptable interference for other spectrum users, and signal attenuation as the signal traverses the line make it necessary to regenerate or repeat the signal periodically. This can be done by using MV couplers to couple the broadband signal off the MV line so that it can be regenerated if necessary and amplified before being fed back onto the MV line through another coupler. Repeaters, on the other hand, could add latency (especially if the signal is regenerated) and could also create single points of failure, because a single bad repeater can bring down an entire communication line.

The distribution transformers that change voltage levels between MV and LV lines are particularly hard on the weak broadband signal. Transformers, which are intended to pass low frequencies near 50 or 60 Hz, appear open circuits for the passage of higher-frequency signals and typically attenuate and distort the weak broadband signal beyond recoverability and usability. This implies that BPL signals going between MV and LV lines need to bypass the transformers. Typically, the bypass line can also have built-in equalizing functionality at a small incremental cost. The recent capability to effectively and safely bypass transformers has been instrumental to the success and deployment of BPL.

**Typical Broadband over Power Line Architecture**

A point of presence (POP) is needed to connect the BPL network to the local distribution network or the Internet. A public switched telephone network (PSTN) or a mobile network. The connection is made through a backhaul network that connects to the BPL distribution line. Typically set to a power substitution where multiple MV lines are connected. The backhaul network is typically a bi-directional device that converts data formats, aggregates, and concentrates uplink downlink, processes, maintains functionality, helps allocate bandwidth, and monitors, generates billing and charging data, and provides various backhaul Ethernet interfaces to fiber-optic or wireless connections.

Even though the importance and direct socioeconomic impact of access to broadband services are well understood, currently only about 4% of the Earth's population has access to some type of broadband service, typically via DSL or cable modem. BPL offers a new, potentially powerful alternative means of providing high-speed Internet service, voice over Internet protocol (VoIP), and other broadband services to homes and businesses by using existing MV and LV power lines. Because roughly 60% of the Earth's inhabitants have access to power lines, BPL could play a significant role in bridging the existing digital divide. But the success of BPL, like that of any new technology in its infancy, depends on much more than simple technological results or successful field testing. It also depends greatly on the appropriate business models and deployment plans.

**Conclusion**

As the regulatory uncertainties and interference issues surrounding BPL dissipate, and with the successes of many trials and early commercial deployments, the release of various standards, and the growing availability of reasonably priced standardized and reliable equipment, the road to BPL is becoming increasingly well paved and BPL seems to be well entrenched. Indeed, BPL's future looks very bright.

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**About the Authors**

*Lee Lushbaugh*
President, Bechtel Communications, Inc.
Mr. Lushbaugh provides day-to-day direction to project directors and regional managers on all issues relating to Bechtel's performance on contracts totaling approximately $1.5 billion in revenue annually. Previously, he was the program director for the Groom Creek BLM Services Project, with overall responsibility for the GIP's relationship with Groom Creek, LLC in Austin, Texas. He is a 20-year Bechtel employee who has served both functional and operational roles in the power and telecommunications business lines.

*S. Rasoul Safavian*
Vice President and Chief Technology Officer— Americas, Bechtel Communications, Inc.
Bechtel is an engineering and construction services company and is a leader in the design, development, construction, and operation of energy-related projects. Mr. Safavian oversees the company's technology development and supports the technology needs of BechTEL's clients in the Americas. He is responsible for the development and implementation of new technologies that can improve the competitiveness of the company and its clients.

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[More on this topic at www.nhn.org/bridge](http://www.nhn.org/bridge)
Member Profiles

Michael A. Janaw
Senior Engineer Technical Staff
Union Commercial Bank, AIC
Networking Systems

Career Highlights
Being part of the team that accepted a "Technical Integrity" Award for Sunnys's Compliance
Breakthrough was a highlight of my career. It was a real team effort, and it was
great to gain industry recognition for our work.

Sunnys's successful product launch in U.S.
market. It is heartening to see the system I
developed become a source of entertain-
ment and information for millions of
subscribers. But believe it or not, what gives
me the most satisfaction is the process of
understanding how a technology or process
works—not specifically, but deeply, into that
improvement and optimization become
almost obvious.

Education and Career
My formal education and technical work at
Sunnys. For instance, MIT's graduate-level course on
multi-
dimensional signal processing was directly
applicable to my very first project at Sunnys,
which involved designing an advanced TV
system that " NEC" detail information in unusual
portions of the SD video spectrum.

Advice to Engineering
Graduates
I was a technical manager for many years,
and
I had no formal training in this area.
I know that many engineering colleges and
universities now offer some technical leadership
training. But I feel that you have leadership
qualities or have been told that you do,
I recommend taking one or two class in these
management courses, as it will be sure to
come in handy in your career.

Earl McCune
Co-founder, Chief Technical Officer
Office of the President of Engineering

Sydney S. Weinstein
Chief Technical Officer
SevenEcho, LLC

Career Highlights
Several highlights come immediately to mind. The two most significant are:

1. The equipment management engineer I inherited a project that was assigned a limited
budget, and the project was late. The engineer and I worked together to improve the
delivery, and the project was completed on time.

2. The development of a new product line for the telecommunications industry. The
project was a success, and the new product line became the backbone of the company's
sales for the next five years.

Education and Career

Beyond learning the details of engineering, education is here to teach us how to think.
I have learned that all education is a good investment. My decision to go back to graduate
college after 17 years in my career is a good sign of that. But education must be
integrated with experiences that are most meaningful.

Advice to Engineering
Graduates

Be flexible and adaptive in your career. Above all, continuously strive to thoroughly
understand the fundamentals of your chosen specialty, as this will allow you to
adapt to inevitable changes. I am amazed at how many people do not do this.

I am fortunate in that I know what I wanted to

I am still doing it and still enjoying what I do. That's more important than
the money or anything else—to work at what you love.

I have a feeling of work I do better, and I enjoy it.

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presented by the International Engineering Consortium

IEC Publications is proud to be a leader in continuing education in the information
and communications technologies industry. We hope you will find a variety of
tools to suit you, whether you are brushing up on the latest in your area of
expertise, taking the first step in learning about an unfamiliar field, or
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field because it takes a simple yet thorough look at some of the
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voice over Internet protocol, cellular, and IPTV.

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the Publications team.

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electronics engineering topics. For details on preparing a paper or
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To submit a manuscript, contact Andre Sulluchuco at +1-312-559-4658 or asulluchuco@iec.org.

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HKN members receive a 20% discount when using
discount code HKN on-line at www.iec.org/pubs.
As an engineer, you have a lot on your mind. That's why it's good to keep things simple when it comes to managing your career.

Eta Kappa Nu and Experience teamed up last fall to deliver an exclusive career center for members just like you. Have you accessed your account yet?

- **FREE** access to thousands of job opportunities
- **FREE** member to member job postings
- **FREE** content addressing interview and resume tips and techniques, professional profiles and articles of interest to those in the professional world
- **FREE** career resources from Hoovers, Salary.com and more

Whether you're looking to start your career, seeking a job or needing to fill a position at your company with an HKN engineering professional, Experience is the exclusive destination for members at the nation's top engineering schools and technology-minded firms.

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**Eta Kappa Nu Association Financial Report**

For the year ended June 30, 2007 (Reviewed)

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**STATEMENT OF FINANCIAL POSITION**

**ASSETS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash and cash equivalents</td>
<td>$210,371</td>
</tr>
<tr>
<td>Membership receivable</td>
<td>4,950</td>
</tr>
<tr>
<td>Awards inventory</td>
<td>6,374</td>
</tr>
<tr>
<td>Prevent expenses</td>
<td>3,103</td>
</tr>
<tr>
<td><strong>Total current assets</strong></td>
<td>224,448</td>
</tr>
</tbody>
</table>

**LIABILITIES AND NET WORTH**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>CURRENT LIABILITIES</td>
<td>$11,928</td>
</tr>
<tr>
<td>Accounts payable</td>
<td></td>
</tr>
<tr>
<td>Accrued Expenses</td>
<td></td>
</tr>
<tr>
<td>Administrative Expenses</td>
<td>227,767</td>
</tr>
<tr>
<td><strong>Total current liabilities</strong></td>
<td>240,684</td>
</tr>
</tbody>
</table>

**INVESTMENTS - at Market Value**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total assets</td>
<td>$1,180,950</td>
</tr>
</tbody>
</table>

**NET ASSETS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted</td>
<td>500,097</td>
</tr>
<tr>
<td><strong>Total liabilities &amp; net worth</strong></td>
<td>$1,680,047</td>
</tr>
</tbody>
</table>

---

**STATEMENT OF ACTIVITIES**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>REVENUE</td>
<td></td>
</tr>
<tr>
<td>Memberships</td>
<td>$104,785</td>
</tr>
<tr>
<td>BRIDGE magazine subscription</td>
<td>74,881</td>
</tr>
<tr>
<td>Merchandise sales (net of $6,374 of costs incurred)</td>
<td>14,623</td>
</tr>
<tr>
<td>Contributions</td>
<td>39,737</td>
</tr>
<tr>
<td><strong>Total Revenue from Operations</strong></td>
<td>234,068</td>
</tr>
</tbody>
</table>

**OTHER INCOME**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dividends and Interest</td>
<td>$33,721</td>
</tr>
<tr>
<td>Realized gains on the sale of investments</td>
<td>5,469</td>
</tr>
<tr>
<td>Market value appreciation of investments</td>
<td>71,707</td>
</tr>
<tr>
<td><strong>Net Other Income</strong></td>
<td>111,177</td>
</tr>
</tbody>
</table>

**NET GAIN**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NET ASSETS - BEGINNING OF YEAR</strong></td>
<td>388,780</td>
</tr>
<tr>
<td><strong>NET ASSETS - END OF YEAR</strong></td>
<td>500,097</td>
</tr>
</tbody>
</table>

---

**STATEMENT OF CASH FLOWS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>CASH FLOWS FROM (USED FOR) OPERATING ACTIVITIES</td>
<td></td>
</tr>
<tr>
<td>Cash received from memberships, contributions and program activities</td>
<td>$161,101</td>
</tr>
<tr>
<td>Cash paid for operations</td>
<td>(208,039)</td>
</tr>
<tr>
<td><strong>Net cash used for operating activities</strong></td>
<td>(56,932)</td>
</tr>
</tbody>
</table>

**CASH FLOWS FROM (USED FOR) INVESTING ACTIVITIES**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment earnings</td>
<td>33,721</td>
</tr>
<tr>
<td>Proceeds from the sales of investments</td>
<td>253,665</td>
</tr>
<tr>
<td>Purchases of marketable securities</td>
<td>(234,709)</td>
</tr>
<tr>
<td><strong>Net cash from investment activities</strong></td>
<td>50,658</td>
</tr>
</tbody>
</table>

**NET INCREASE IN CASH AND CASH EQUIVALENTS**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>23,735</strong></td>
<td></td>
</tr>
</tbody>
</table>

**CASH AND CASH EQUIVALENTS BEGINNING OF YEAR**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>185,098</strong></td>
<td></td>
</tr>
</tbody>
</table>

**CASH AND CASH EQUIVALENTS END OF YEAR**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>210,833</strong></td>
<td></td>
</tr>
</tbody>
</table>

---

Reconciliation of Net Gain to Net Cash Used for Operating Activities

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NET GAIN</strong></td>
<td>$112,117</td>
</tr>
</tbody>
</table>

**ADJUSTMENT TO RECONCILE NET GAIN TO NET CASH USED FOR OPERATING ACTIVITIES**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment activity attributable to investing activities</td>
<td>(111,117)</td>
</tr>
<tr>
<td>Cash received or expended to</td>
<td></td>
</tr>
<tr>
<td>Decrease in accounts receivable</td>
<td>1,820</td>
</tr>
<tr>
<td>Increase in inventories</td>
<td>(5,574)</td>
</tr>
<tr>
<td>Increase in accounts payable and accrued expenses</td>
<td>38,627</td>
</tr>
<tr>
<td>Decrease in unearned subscription revenue</td>
<td>(62,055)</td>
</tr>
</tbody>
</table>

**Net cash used for operating activities**

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(234,709)</strong></td>
<td></td>
</tr>
</tbody>
</table>

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The HKN Web Site

HKN News Features
HKN members can stay up to date on the latest society activities and notable accomplishments of fellow members by visiting the HKN Web site. The site's home page features news headlines that link to articles and press releases.

Career and Alumni Services
Job openings, free career posts to other HKN members, resume and interview techniques, and networking opportunities are available through Experience, Inc. Free registration is available on the HKN Web site.

Chapter Administration Forms and Information
Everything needed to establish and run an HKN chapter is available in one spot on the HKN Web site.