# THE·BRIDGE

*The Magazine of Eta Kappa Nu*

## A Closer Look at
## Engineering Careers

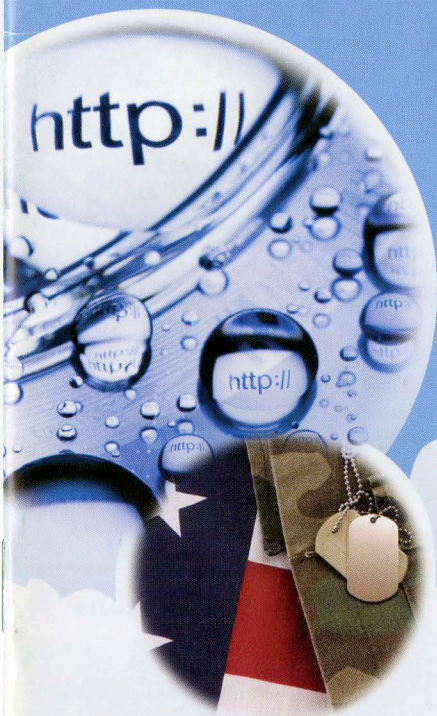http://

**HKN**

**www.hkn.org**

## LETTER FROM THE EXECUTIVE DIRECTOR

*Roger L. Plummer*

Dear HKN members,

The end of a year always provides an opportunity to review the year's accomplishments and develop plans for the future. As I look back on 2007, I see many accomplishments of which all HKN members should be proud.

In the spring, HKN and the IEEE cooperated in a project that resulted in the updating of personal contact information for nearly 2,000 HKN members. This will enable us to reach many of our members whose addresses were outdated and for whom we did not have e-mail addresses. We hope this additional access will allow us to reconnect with those who have lost touch with HKN.

Over the summer we partnered with Experience Inc., a career database. This partnership offers value to all members of HKN. Professional members of HKN can post jobs to other HKN members at no cost. Companies can target their job opportunities to HKN members, ensuring that the brightest electrical and computer engineers are seeing their ads. Visit the HKN Web site (**www.hkn.org**) to see all that this partnership has to offer.
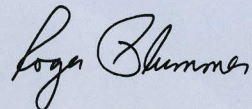
The awards program continues to recognize outstanding individuals for their contributions in the fields of electrical and computer engineering. The profiles of three new Eminent Members are included in this issue.

This fall Mu chapter at the University of California Berkeley and Gamma Theta chapter at the University of Missouri-Rolla held student leadership conferences. Each was enthusiastically received, and we congratulate the members of these chapters on a job well done. We also wish to thank the alumni and corporate sponsors, whose support of these student activities allowed students to participate in these events at no charge. We will continue to seek your support as more opportunities for student activities develop.

I hope you enjoy this issue of *THE BRIDGE*, which features articles that today's students as well as today's professionals will find useful.

Finally, we know that HKN members are engaged in a variety of technical as well as social activities; many are entrepreneurs and adventurers with a story to tell. We know that others, especially our students, will be inspired by your accomplishments, and we will occasionally share such experiences with our readers in the future. You can e-mail your story to me at *executive@hkn.org* or to *THE BRIDGE* Editor Barry Sullivan at *editor@hkn.org*.

Warm regards,

*Roger Plummer*

*Executive Director*

## LETTER FROM THE EDITOR

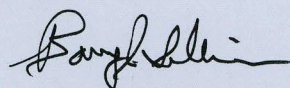*Barry J. Sullivan | Beta Omicron Chapter Member*

The last issue of *THE BRIDGE* addressed the evolution of engineering education. In the current issue, we explore a few of the many directions the careers launched by that education can take. We cannot capture all the variety in a single issue on this topic, but we do present a broad range of experiences.

In our first featured article, Harish Agarwal shares what he learned from his experience in launching a web-based enterprise. Next, Teresa (Olson) Pace, the 2001 HKN Outstanding Young Electrical and Computer Engineer Award recipient, describes her work in image processing in the context of supporting and protecting members of the armed services.

Lyle Feisel proposes "Lyle's Law of Mutuality," highlighting the importance of matching team goals with those of the individual members. Finally, Richard Gowen, HKN Eminent Member, reflects on a career that has included roles as a researcher, manager, educator, and administrator.

We also introduce a new section on Member Profiles in this issue, offering the opportunity for members to share lessons learned from their careers. If you are interested in contributing an article or a profile, see Page 21 for more information and drop me a note at *editor@hkn.org*.

Warm regards,

*Barry Sullivan*

*THE BRIDGE Editor*

# THE·BRIDGE
*The Magazine of Eta Kappa Nu*

## features

# 2007 Leadership Conferences

## MU CHAPTER

### Two Student Leadership Conferences Offered This Fall

HKN is pleased that two Outstanding Chapter Award winners, Mu chapter at the University of California, Berkeley and Gamma Theta chapter at the University of Missouri, Rolla, hosted student leadership conferences October 26–27, 2007, and November 2–3, 2007, respectively.

Both conferences were developed as a result of the enthusiastic feedback of participants at the conference hosted by Beta chapter at Purdue University in 2006. Each program was unique in its content but included team projects, keynote addresses from distinguished professionals, networking opportunities, and a chapter management workshop.

Mu chapter's conference, entitled "Making a Difference: Leadership through Innovation," included a photo hunt around campus. This has always been a fun project for their pledges, and they wanted to share it with conference attendees. It gave attendees a chance to view Berkeley's beautiful campus while working cooperatively with their team. Attendees also went on the Advanced Light Source Tour at Lawrence Berkeley National Laboratory. To view conference details and the agenda, please visit their Web site at **http://hkn.berkeley.edu/conference**.

Gamma Theta's conference, "Leadership for a New Century," focused on the engineer of the future and included a panel of professionals considering the world of 2030. Dr. Kevin Schneider, Gamma Theta member and chief technical officer of Adtran, presented the dinner keynote address. Other speakers discussed public policy, career management for recent graduates, and adapting to changing technology. Visit their conference Web site at **www.umr.edu/hknconf** for details about the agenda and speakers.

Both conferences were planned entirely by the chapter members who invited speakers, solicited sponsorships, and secured the facilities. No registration fee was required for either event, thanks to the generous donations of HKN members as well as sponsors Adtran, Dynetics, Garmin, and Burns & McDonnell for UMR and Meltwater, Informatica, and Moto Development Group for UCB. If you would like to help support future conferences, please use the envelope enclosed in this issue to send your tax-deductible donation to HKN headquarters. Conference details are available on the HKN Web site and wrap-up materials will be posted soon at **http://hkn.org/news/student_conferences.html**.

Gamma Theta officers hosted "Leadership for a New Century" at the University of Missouri, Rolla.

Mu chapter at the University of California, Berkeley organized "Making a Difference: Leadership through Innovation."

## GAMMA THETA CHAPTER

# From Ph.D. to HTTP

*by Harish Agarwal*

A s a senior in college, I assumed my choices for the future were either to get a job as a computer engineer that I would be at for the rest of my life or to avoid one by staying in school. The decision was an obvious one for me—I applied to graduate school. Five years later, I find myself leaving behind my choice of convenience to do something entirely different—build a company with friends.

About a year ago, I started having conversations with a good friend about a problem he was working on with a friend of his: finding electronic parts. Although it started as a simple idea they worked on at night, it soon blossomed into a company—Octopart. At many points throughout these months, my friend asked to me to join him. I had never considered trying to start a company before and was afraid of taking the plunge into something so far removed from what I knew. A stream of questions filled my mind—how can I leave grad school without finishing? What kind of classes do you take to learn how to start a business? And the one I liked to think about the least—what if we failed?

It was clear to me relatively early on that I was not as passionate about grad school as some of my colleagues. And yet, with no alternative in mind, I stayed past my entrance exams, finished classes, and worked on my research project for a few years. After I observed how happy my friend was while working on Octopart, I started helping him out at night, to fill the time. I soon went from working on it during the nights to filling my weekends with it, and sneaking "breaks" into the workday to develop it a li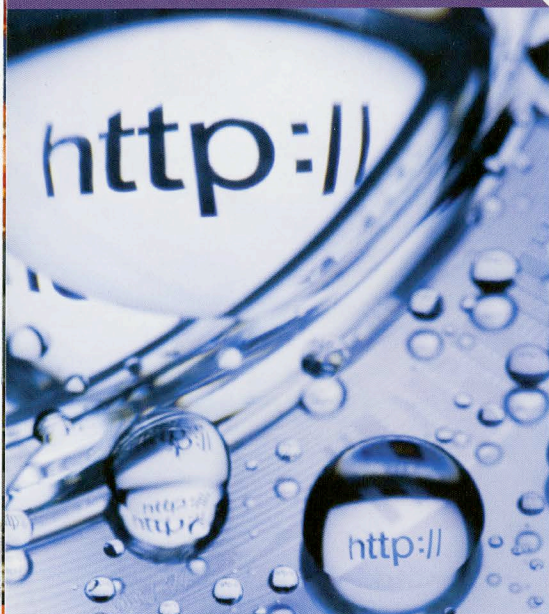ttle more. Once I realized that I was never going to be as passionate about research as I was about my side project, my decision to leave became easy.

## Just Do It

Since joining Octopart, it has become obvious to me that the only way to learn how to start a company is to go out and do it. Although the first few steps may seem mysterious, the most important part of starting a company from scratch is to start working on an initial version of your product as soon as possible. Incorporating a company and the other details you may not know about are just that—details. However, a company will be dead on arrival without a lot of time spent on developing the product; this requires blood, sweat, tears, and, yes, money. The amount of money depends on the kind of company you are starting.

## Finding Funding

Octopart is an Internet company. The traditional route for funding an Internet start-up is through venture capital firms located in Silicon Valley. Venture capital firms raise large sums of money by pooling together investments from their limited partners (which range from private investors to the managers of university endowments).
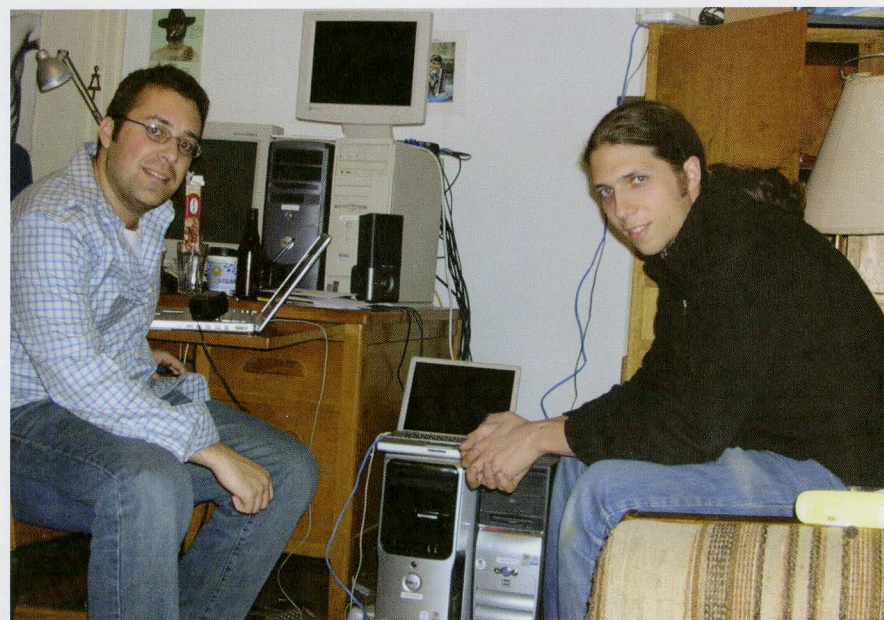


Andres Morey (left) and Sam Wurzel (right), founders of Octopart, in their apartment and Octopart's first office.

They then invest this money into young companies with a huge potential for growth. The investments are risky, but what venture capital firms are looking for is the rare company that will pay out many times over on their initial investment and cover the cost of the fund. Venture capitalists examine a huge number of young companies a year, on the order of hundreds, and make deals with a small fraction of them, on the order of tens. They will typically invest a few million dollars in a company to buy anywhere from 20 to 50 percent of it. This money is enough to rent an office, hire employees, and buy the hardware necessary to support your company, but it also comes with the cost of selling a part of your company to the firm—now the firm will also have a say in running your business.

The good news for Internet companies is that the old model of raising large sums of money from venture capital firms is being encroached on by smaller incubators such as Paul Graham's Y Combinator (http://ycombinator.com).

Y Combinator provides a small round of investment (about $15,000) for a large return on good advice from seasoned Internet entrepreneurs. With the advent of open-source software and cheap computer hardware, this small round of investment is enough money for a couple of people to buy a server and pay themselves to spend a few months developing an initial version of a software product. It was with this kind of an investment that octopart.com was born.

## Learning By Doing

While all three of us had no experience with Web and database programming a year ago, the problem-solving background we each had as engineering majors allowed us to pick these skills up very quickly. One of the co-founders has now also delved into the business aspect of the company, and I believe it is this same analytical skill-set that has allowed him to perform well in that arena. Nearly a year after the initial version of the Web site launched, the three of us, along with two friends who have joined us since, are all still working on continually growing the site.

## Conclusion

It would be very easy for me to rejoice in my experience thus far if we were already wildly successful. However, Octopart is still in a very early stage with no guaranteed chance of success. My days are long and tiring. And yet, I would not trade this experience for the world. My quality of life has increased tenfold since finding something that I am truly passionate about. The question "What if we fail?" still crosses my mind, and the answer is simple: we will try again.

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

## ABOUT THE AUTHOR
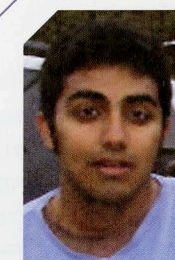
### Harish Agarwal
*Alpha chapter – University of Illinois at Urbana-Champaign*

Before joining Octopart, Harish was a graduate student in biophysics at U.C. Berkeley. In his spare time he built a 25' by 30' kite out of heavy-duty trash bags, which nearly dragged him into the ocean. Prior to making the trek out to California, Harish grew up in suburban Chicago and attended the University of Illinois at Urbana-Champaign, where he was a proud member of the electrical and computer engineering department.

# Working to Defend the Ones Who Defend Us

*by Teresa Pace*

**W**orking as an electrical engineer specializing in image-processing algorithms for a defense contractor is anything but dull. The DRS Technologies Reconnaissance, Surveillance, and Target Acquisition (RSTA) segment, where I work, supplies a wide variety of products for all branches of the U.S. military. These products include airborne infrared sight and night vision systems, ground vehicle systems such as the Driver's Vision Enhancer (DVE), maritime systems, and soldier systems such as handheld thermal imagers, tactical lasers, and thermal weapon sights, as well as the electro-optic technology that supports these systems. One of the most rewarding aspects of the work that I do is that it aids in improving our products and directly impacts the ability of our warfighters to perform on the battlefield now and in the future. It's important to know that what I do makes a difference and can help to save soldiers' lives.

At DRS, I am part of the image and signal processing (ISP) group. As an image processor, I develop algorithms (sets of mathematical rules for specifying how to solve problems) that manipulate images in order to extract information from them. Mathematical algorithms are to imaging sensors what the brain is to the eye in its quest to understand what it sees. These mathematical algorithms include enhancing images for improved visualization or automatically searching images in order to detect, track, and identify targets.

The images our ISP group works with are produced by electro-optical (E/O) devices, which basically means that they are systems that interact with light in some way. E/O sensors include both visible and infrared (IR). Visible sensors have wavelengths from .39–.75 um and can be identified as digital cameras, video cameras, or TVs. Infrared sensors have wavelengths from .75–12 um and are used in a wide variety of disciplines, including defense, communication, medicine, art, astronomy, and archeology. Infrared literally means "below red" because red is the color of the longest wavelength of visible light.

## Imaging Sensors

There are many types of infrared sensors. Reflected infrared refers to IR light reflected off a scene. In other words, there must be some small amount of light for these sensors to work. There are two types of reflected IR sensors: near IR (NIR), which has a wavelength range of .75–.9um, and shortwave IR (SWIR), which has wavelengths from .9–1.7 um. NIR sensors are used in fiber optics, image intensifiers, and night vision goggles (see *Figure 1*). SWIR sensors are used for long-distance telecommunications and longer-range identification (ID). Thermal IR sensors measure the amount of heat emitted from a scene, and therefore they do not need any light to operate. Thermal IR sensors can be broken into two categories: midwave IR (MWIR) and long-wave IR (LWIR). MWIR sensors operate in the 3–5 um range. Many heat-seeking missiles operate in this range. LWIR sensors operate in the 8–12 um range. Many forward-looking infrared (FLIR) systems on aircrafts use this area of the spectrum. Most thermal sensors require their detectors to be shielded from heat and chilled with liquid nitrogen to form images.



| Figure 1 | NIR – Night Vision Goggles |

However, there are uncooled sensors in the long-wave realm. These uncooled sensors do not typically perform as well as the cooled systems, but they are much more affordable and as technology advances, so does their performance.

A thermal imaging system is typically comprised of a scene giving off infrared energy or heat, optical elements through which the energy is focused, an infrared detector that measures incoming photons, the signal processor that manipulates the image produced by the detector, and finally a video monitor for display. Image processors extract the image from the digital data stream after it is read out of the detector in order to enhance it, eliminate noise (referred to as denoising), or retrieve information.

Night vision systems are used in defense, the police force, and navigation. The defense industry uses monocular scopes, which can be handheld or mounted on a weapon, night vision goggles, and FLIR systems for ground, air, and maritime vehicles.
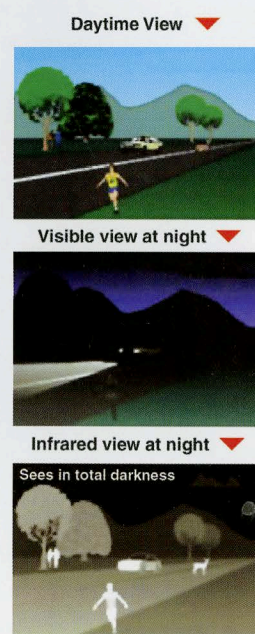


**Daytime View** ▼

**Visible view at night** ▼

**Infrared view at night** ▼

Sees in total darkness

| Figure 2 | Scenes at Different Times of Day with Different Sensors |

The police force uses night vision sensors on helicopters to search for criminals in the dark. Navigation night vision systems are used on ships to avoid collision as well as on cars to improve visibility at night, allowing the driver to see more and farther (see *Figure 2*).

## Image Enhancement

One specific area where our ISP group focuses its efforts is on image enhancement. Image enhancement is important for infrared imagery as well as other electro-optical imagery because E/O images are typically plagued by poor contrast. While most systems have the ability to adjust brightness and contrast to improve the image, it usually does not work well over the entire image. This can be very challenging for soldiers trying to view a display, understand what they are seeing, and make appropriate tactical decisions. Therefore, using image processing to enhance the contrast across an image is extremely beneficial.
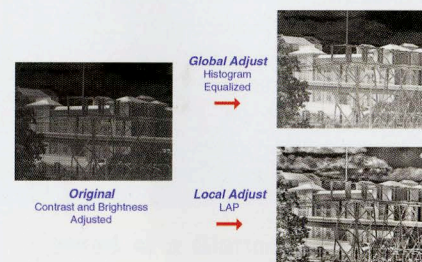


Original
Contrast and Brightness Adjusted

Global Adjust
Histogram Equalized

Local Adjust
LAP

| Figure 3 | IR Imagery Processed Globally and Locally |

There are many methods of image enhancement. One approach is to apply a global histogram to the image. The idea behind this is to adjust the intensity values in an image to match a specific desired histogram. The most common method for this is histogram equalization. However, global histogram matching doesn't always bring out the details in an image. Therefore, a local-area contrast enhancement (LACE) is necessary. LACE allows details to be pulled out of bright and dark regions simultaneously. Additional image enhancement can be performed through sharpening. In this article, local-area processing
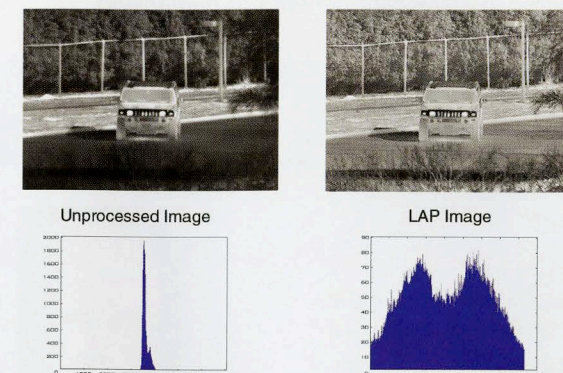


Unprocessed Image

LAP Image

| Figure 4 | Histograms of an Unprocessed and LAP–Processed IR Image |

(LAP) is referred to as the combination of sharpening and LACE. The sharpening can be done either before or after LAP depending on preference. *Figure 3* shows an example of a cooled infrared image along with a histogram equalized version and an LAP processed version. The original image looks good in standalone. However, if one is interested in more detail, it becomes difficult to identify it in this image. The histogram-equalized image brings out additional detail such as the power line structure and the clouds that were originally in shadow. The drawback is that it saturates some areas, making it difficult to see detail in those locations. The LAP–processed image shows detail in both light and dark areas simultaneously. *Figure 4* shows how the histogram of the locally processed image is radically different from the non-processed image.

The bits are spread across the dynamic range and the histogram matched a bimodal Gaussian. The output data was scaled for display purposes to the 8-bit range.

Image enhancement is only one of many interesting areas where the ISP team focuses its image-processing skills. In addition, we investigate algorithms for unmanned aerial vehicles (UAVs), improved situational awareness, missile warning/detection, hostile fire indication, homeland security (border monitoring initiatives), identification of suicide bombers, and improvement of brownout conditions for helicopters in Iraq.

## Conclusion

Image processing and mathematics permeate every aspect of our lives, and together they can be used to better understand our world. In my case I use them to help keep our soldiers safe and out of harm's way. DRS has allowed me the opportunity to do this, and in the process I have found a very challenging and rewarding career.

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

## ABOUT THE AUTHOR

### Teresa Pace
*Director of Engineering, DRS Optronics Technologies*
*Eta chapter – Board of Directors*

Dr. Pace received her undergraduate degree from Wright State University and her doctoral degree from The Pennsylvania State University, both in electrical engineering. Dr. Pace is currently responsible for image processing algorithm development for electro-optical imaging technologies. Prior to DRS Optronics Technologies, she specialized in image processing and systems engineering as a consultant at Lockheed Martin. Dr. Pace has been awarded six patents and has written 49 journal and conference publications. In 2001, she was selected as HKN's Outstanding Young Engineer of the Year.

# Three New Eminent Members Inducted

*Eta Kappa Nu established the rank of Eminent Member in 1950 as the society's highest membership classification. It is conferred upon those select few whose contributions and attainments in the field of electrical and computer engineering have resulted in significant benefits to humankind.*

**EMINENT MEMBER** — Presented September 2007

## Gordon Bell

Gordon Bell ranks as one of the most influential pioneers of the computer industry. During his 23 years at Digital Equipment Corporation, he was the architect of various mini- and time-sharing computers and led the development of DEC's VAX and the VAX Computing Environment. As the head of the Computing Directorate at the National Science Foundation, he led the National Research and Education Network (NREN) panel, which created the plan for the Internet. He was also an author of the first High Performance Computer and Communications Initiative while he was at NSF. He established the ACM Gordon Bell Prize, administered by the ACM and IEEE, to encourage development in parallel processing. He continues to break new ground in information technology as the subject for the MyLifeBits project, an experiment in "lifelogging," an automated store of the documents, pictures, and sounds an individual has experienced in his or her lifetime.

### Bell at a Glance

> Principal researcher, Microsoft Research
> Founder and director, Bell-Mason Group
> Vice president of Research and Development, Digital Equipment Corporation (1960–1983)
> Professor of Computer Science and Electrical Engineering at Carnegie-Mellon University (1966–72)
> Assistant director, Computing Directorate, National Science Foundation (1986–1987)
> HKN Vladamir Karapetoff Award, IEEE Von Neumann Medal, National Medal of Technology; National Academy of Engineering, National Academy of Sciences; Fellow of the American Academy of Arts and Sciences, American Association for the Advancement of Science, ACM and IEEE
> Member, Beta Theta chapter
> B.S. and M.S. in electrical engineering from Massachusetts Institute of Technology

**EMINENT MEMBER** — Presented September 2007
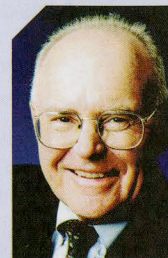
## Gordon E. Moore

Gordon Moore is most widely known for "Moore's Law," his 1965 prediction that the number of components the semiconductor industry would be able to place on a computer chip would double every year. This rule of thumb, which he revised in 1975 to a doubling of chip capacity every two years, originated as an observation on the rapid pace of technology development in an emerging industry. As a co-founder of both Fairchild Semiconductor and Intel Corporation, however, Moore was in a position to not only make keen observations, but also to lead the industry in a direction that assured the veracity of his prediction. That Moore's Law became a guiding principle for the delivery of ever more powerful chips at proportionately lower costs is a testament to both his pioneering vision and leadership.

### Moore at a Glance

> Chairman emeritus, Intel Corporation
> Former executive vice president, president, chief executive officer, and chairman, Intel Corporation
> Co-founder, Fairchild Semiconductor and Intel Corporation
> Director, Gilead Sciences Inc.
> Trustee, California Institute of Technology
> Recipient, National Medal of Technology and Medal of Freedom
> Member, National Academy of Engineering; fellow, Royal Society of Engineers
> B.S. in chemistry from University of California at Berkeley, Ph.D. in chemistry and physics from California Institute of Technology

**EMINENT MEMBER** — Presented June 2007

## Wallace S. Read

Wallace Read was born in Corner Brook, Newfoundland, Canada, and spent his early career in the pulp and paper and hydroelectric power industries in his native province. After serving as the first full-time president of the Canadian Electricity Association (CEA), he brought a worldview to the IEEE standards process that forever changed the way the organization serves its constituents. As vice president of IEEE Standards Activities from 1993 to 1994, he strengthened relations with the International Electrotechnical Commission (IEC), the International Telecommunications Union (ITU), and the International Organization for Standardization (ISO), thereby positioning the IEEE for a greater leadership role in international standards development. Upon retirement in 1995, Read formed REMAS Inc., a provider of electric power consulting services to utilities and governments.

### Read at a Glance

> President, REMAS Inc.
> President, Canadian Electricity Association (1985–1995)
> President, Institute of Electrical and Electronics Engineers (1996)
> Fellow, Canadian Academy of Engineers, Engineering Institute of Canada (EIC), and IEEE
> EIC Julian C. Smith Medal and Sir John Kennedy Medal, CEA Distinguished Service Award, Canadian Standards Association John Jenkins Award, Canadian Council of Professional Engineers Gold Medal, and IEEE Charles Proteus Steinmetz Medal
> Member of the Order of Canada
> Doctor of Engineering (Honoris Causa), Technical University of Nova Scotia and Memorial University of Newfoundland
> B.E. from Nova Scotia Technical College

# HKN Award Nominations

*HKN invites its members to nominate outstanding individuals for these prestigious awards. Nomination details and forms can be found at* **www.hkn.org/awards.**

### Outstanding Young Electrical and Computer Engineer

> *Presented annually to an exceptional young engineer who has demonstrated significant contributions early in his or her professional career*
> *Nominations due April 1, 2008*

### Vladimir Karapetoff Outstanding Technical Achievement Award

> *Recognizes an individual who has distinguished himself or herself through an invention, development, or discovery in the field of electrical or computer technology*
> *Nominations ongoing*

### Distinguished Service Award

> *Acknowledges an individual who has devoted time and energy to the Eta Kappa Nu Association through years of active participation*
> *Nominations ongoing*

### Outstanding ECE Student Award

> *Annually identifies an ECE senior who has proven outstanding scholastic excellence; high moral character; and exemplary service to classmates, university, community, and country*
> *Nominations due June 30 to the LA Alumni chapter*

### Outstanding Chapter Award

> *Singles out chapters that have shown excellence in their activities and service at the department, university, and community levels*
> *Winners are determined by their required Annual Chapter Reports, due October 15 for the preceding academic year*

### C. Holmes MacDonald Outstanding Teaching Award

> *Presented annually to a dedicated young professor who has proven exceptional dedication to ECE education and has found the balance between pressure for research and publications and enthusiasm and creativity in the classroom*
> *Nominations due June 30*

# Lyle's Law of Mutuality

## by Lyle D. Feisel *

**A group can only succeed if its individual members succeed. And vice versa.**

T his summer, somewhat to my surprise, Dorothy and I celebrated our golden wedding anniversary. It was a surprise not because we had been married that long, but simply because it had been that long. Fifty years—and a wonderful 50 years it has been—is a long time. Half of a century. One-twentieth of a millennium. Does this give me a license to expound on what makes a successful marriage? I don't think so. I'll leave that to the psychologists and sociologists. It does, however, give me an opportunity to talk about one characteristic of a marriage that seems to apply to any kind of partnership. The result will be Lyle's Law of Mutuality, which shall be revealed shortly.

I was first introduced to this notion back when I was in the Navy and, having completed boot camp and nine months of technical school, reported aboard the *USS Norton Sound*. Like most other members of the crew, I was assigned to a position in what is known as the "sea and anchor detail," which defines everyone's job when the ship is entering or leaving port or an anchorage. Since I had yet to achieve the status of petty officer, my position was as a member of a line-handling party on the ship's fantail. "Party," as used here, is a curious naval term that means group or team but did not in any way describe our activity.

Line handling was no party. It was hard work and, occasionally, quite dangerous. At such times, the boatswain's mate would say, "Okay, boys. One hand for the ship. One hand for yourself."

What did he mean? Well, it took me a while to grasp the full significance of this advice, but I finally deduced that he was telling us to take care of ourselves while also working for the team. A sailor who dedicates himself totally to the ship without any regard for his own safety won't last long in that environment. Some accident will befall him—a parted line, a leg caught in a coil, any number of things. And then, not only is the sailor in pain or worse, the ship has lost a sailor. The sailor is hurt. The ship is hurt.

This principle applies to any collection of people, be it two or ten thousand. Lyle's Law of Mutuality summarizes it this way: **A group can only succeed if its individual members succeed. And vice versa.**

### One Hand for the Ship

Let me comment briefly on a group of two—a marriage. One might conceive of a marriage in which one of the parties totally suppresses his or her identity and dedicates all of one's energy to the partnership, but I wouldn't expect it to be a very successful or a very interesting marriage. I think the best marriage is a partnership of two individuals—each competent and self-reliant in his or her own right, but dedicated as well to their joint mutual success.

But I said I wasn't going to expound on what makes a successful marriage. Let me turn instead to our work. If you are the boss, what kind of employees do you want? There may have been a time when the boss might have asked for employees who put the interest of the company always and far ahead of their own. Can that work? I was tempted to say that it might if the work is simple manual labor, employing workers who are interchangeable and replaceable.

But even here, the workers have to take care of themselves with food and water and occasional rest or they—and their employer—will have a problem. Productivity will decline until the worker has to be replaced —a not inexpensive process in itself.



If the Law of Mutuality holds for manual laborers, how much more so does it apply to professional workers such as engineers. One hand for the ship, certainly. For the professional, this means more than "a full day's work for a fair day's pay." It means accepting and working toward achieving the goals of the organization.

It means exercising the duty of care, protecting the intellectual property, trade secrets, and know-how of the company. It means having a loyalty that admits honest and constructive criticism, but not mean-spirited bad-mouthing.

### One Hand for Yourself

You also need to have one hand for yourself while you are at work. A few sentences ago I said that you need to work toward achieving the goals of the company. Well, you also need goals of your own, and you need to work toward reaching them. Of course, while your goals will not be the same as those of your employer, neither should they be contrary to them. If they are, you should probably be updating your resume.

At the same time, managers have to respect and, indeed, encourage their employees to work in their own interests as well as in the interest of their employer. Not always easy, but, in my opinion, essential. In my own experience, I watched—and I hope helped— associate deans mature and become more capable until they went off to greater responsibilities and rewards. I missed them when they left, but I'm sure they had contributed more to the school than if they had not been growing as they worked.

And one hand for yourself. Outside work, live a life. Enjoy your friends and family. Have a hobby. Go to a party, and forget about work for a while. And continue your education. Many companies used to—and I suppose some still do—support only those educational programs that were directly related to an employee's current job. A sort of unenlightened self-interest position.

The attitude toward education is different today, with the more progressive companies realizing that virtually any education is better than no education at all and, if the employee will learn, the company will provide support.

### Conclusion

In the end, as is usually the case, it is a matter of balance. A group, be it a company, a department, or a line-handling party, is a collection of individuals working together in a situation where the goals of the individuals must be balanced with those of the group. If the balance is upset in either direction—if the sailor pulls on the line with both hands but fails to hold on to the mast, or clings to the mast with both hands and doesn't help with the line—the success of the group will be severely diminished, if not lost altogether. Mutuality—simultaneously working toward their own goals and toward the shared goals of the group—will help assure the attainment of them all.

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

## ABOUT THE AUTHOR
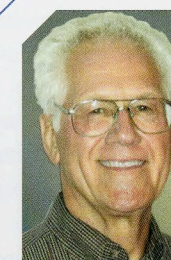
### Lyle D. Feisel
*Dean Emeritus, Thomas J. Watson School of Engineering and Applied Science, State University of New York (SUNY) at Binghamton*
*Nu chapter – Iowa State University*

Dr. Feisel joined the electrical engineering faculty of SUNY Binghamton in 1983. Dr. Feisel is a life fellow of the Institute of Electrical and Electronics Engineers and of the American Society for Engineering Education, and is a fellow of the National Society of Professional Engineers. He is active in the affairs of those organizations and in the development and accreditation of engineering education worldwide. Dr. Feisel received his B.S., M.S. and Ph.D. degrees in electrical engineering from Iowa State University.

# Leading Change

## by Richard Gowen

*HKN Eminent Member Dr. Richard Gowen reflects on his diverse career leading and implementing engineering changes in industry, government, and education.*

Richard Gowen began reaching for unusual paths when he chose to build a maze-mastering electronic mouse as his senior project in EE at Rutgers University. Since transistors were not readily available in 1956, he used vacuum tubes and relays to implement the decision logic. The machine required power from a 5 HP motor-generator. A student member of the IEEE, his mouse paper took second place in the Region Student Paper Contest because it was still three months later that the mouse could successfully run the maze to capture the electronic cheese.

Dr. Gowen began his career as a researcher for the RCA Laboratories and he recalls the interview as very different from the typical senior recruiting trip. He skipped a senior laboratory session to visit RCA expecting a tour of the activities, but instead found himself in a series of oral exams. He never got to complete his responses since as soon as it appeared he

understood the question, he was asked to address a new area. He recognized that this was a company that expected the best possible knowledge in its staff and quickly accepted the offer to join RCA at the top recruiting salary. At RCA he worked with the group developing a crystal wall size TV display, a technology that reached the marketplace 30 years later.

Called to duty with the Air Force, Dr. Gowen left RCA for an assignment at a radar station forty miles from the nearest logging town in northwest Montana. He fondly refers to this assignment as the most intensive graduate course in human relations and technical management possible. As the only engineer, he proposed improvements in the radar system that gave him the opportunity to demonstrate an improved radar system. He was also selected to enter graduate studies in preparation to join the faculty of the then new Air Force Academy.

### Researcher and Educator

In 1959, Dr. Gowen entered the Iowa State University new EE graduate program in Biomedical Engineering and graduated with the MS degree in 1961 and became the first EE PhD in biomedical engineering in 1962. His research included engineering focus studies of the human cardiovascular system which led to a patent to measure blood pressure from a finger while running on a tread mill.

Shortly after joining the faculty of the Air Force Academy Dr. Gowen received his first research contract to develop a capsule transmitter to be inserted in animals to study the medical effects of exposure to nuclear radiation. He was invited by NASA to join the space medical research team for the Gemini program in preparation for the Apollo moon flights and became the director of a joint NASA-Air Force laboratory located at the Air Force Academy. The laboratory developed specialized instrumentation to evaluate the response of astronauts to the weightlessness of space and included the capability to simulate weightless on human subjects (see *Figure 1*).

Dr. Gowen's laboratory developed a system to measure the atrophy of cardiac muscle during the flights to land on the moon. The laboratory also developed a system to evaluate the changes in the cardiovascular system with long duration space flight. He built the first prototype of what became a two million dollar instrument system using coat hangers and strips of metal. The instrument used a capacitor with the skin of the leg as one plate and a suspended band floating off the leg as the second plate. The leg bands measured the resulting shift of body fluid to the lower body to determine the equivalent simulated gravity. The leg bands were used on the three NASA Skylab long duration space experiments in 1972–73. One of the leg bands was returned for post mission testing and is part of the Smithsonian Space Collection.

### Academic Administrator

In 1977 Dr. Gowen became the Dean of Engineering and Vice President of the South Dakota School of Mines and Technology. In 1984 he was appointed the President of Dakota State College to convert the first teachers college of the Dakota Territories to a computer based information management curriculum. The institution transformed into a university with doctoral programs and is recognized as a leading university for computer security and information management. In 1987 Dr. Gowen became the President of the South Dakota School of Mines and Technology, a position he held for 17 years, and led this engineering and science university to expand undergraduate, graduate programs, and research.
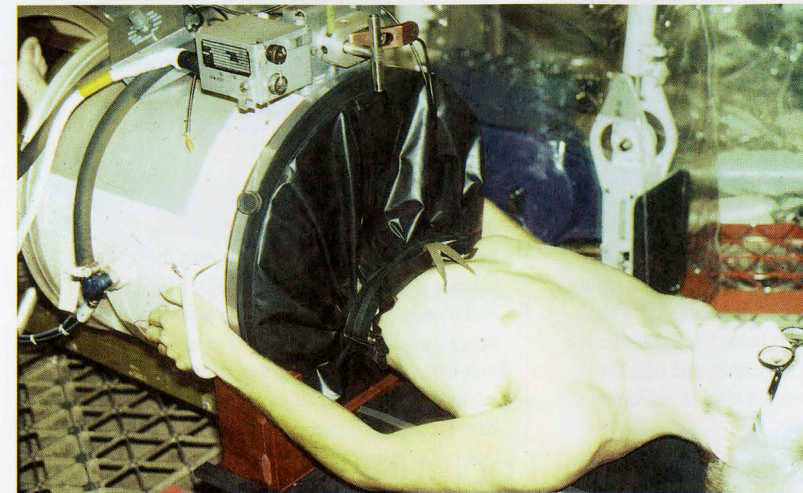
In 2002 the Nobel Prize was awarded for an experiment in the former Homestake gold mine that verified the existence of neutrinos. Dr. Gowen coordinated efforts to obtain the mine for research and upon his retirement as President of the School of Mines in 2003, the Governor of South Dakota appointed him the Director of the Homestake Conversion Project to develop plans for the State to acquire the mine and implement a science and engineering underground laboratory. In 2007 the NSF selected the mine as the site for underground research.

### Professional Service

Dr. Gowen has a long history of involvement with the IEEE and other professional organizations. Working in volunteer activities has given him access to ideas and experiences that have helped his professional career. He served as on the board of directors of organizations for engineers, educators, community organizations and several companies. Dr. Gowen was elected the IEEE Centennial President in 1984 and led the celebration of the century of giants who created the electrical, electronic, and computer technologies that have changed the world.

Dr. Gowen has received many awards and recognitions, including a Honorary Doctorate for Public Service, Distinguished Alumni Award, designation as a Black Hills Diplomat, and the annual Chamber of Commerce George Award. He was designated the South Dakota Engineer of the Year and in 2004 he was similarly recognized as the National Engineer of the year by the NSPE. He continues to have involvement with professional activities and now serves as the president of the IEEE Foundation and the chair of the IEEE history committee.

### Conclusion

Dr. Gowen has enjoyed challenges and in 2006 he worked to develop the Mount Rushmore Institute to advocate freedom and democracy inspired by the sculpture of the four presidents on Mount Rushmore. In 2007 he directed the preparation of a unique forum on the Middle East with panelists from throughout the world. He remains an advocate for recognizing the achievement of excellence through organizations like the IEEE and HKN. Dr. Gowen has served on the board of HKN for six years, was the president of HKN for two terms, served as the chairman of the HKN centennial celebration, and is now the chair of the HKN eminent member nominating committee. He encourages all HKN and IEEE members to recommend outstanding leaders for consideration to be elected an HKN Eminent Member.

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

## ABOUT THE AUTHOR

### Richard Gowen
*Gamma Epsilon chapter – Rutgers University*

Dr. Gowen has served in all the ranks of faculty and academic administration, was president of two universities, and is a member of the South Dakota state board of education. He was a commissioner for the Congressional web learning study, co-chaired the NRC probabilistic risk assessment study for licensing nuclear power plants, led the conversion of a gold mine to a laboratory for neutrino research, and is leading the formation of an institute for freedom and democracy. A fellow of the IEEE, he served as the IEEE centennial president, president of HKN, and is the president of the IEEE Foundation and chair of the IEEE history activities.

# Member Profiles
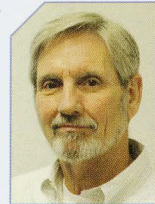
## Ken McCuen
*Chief Technology Officer
Electrical and Software Engineering
Circle Medical Devices*

### Career Highlights

I have made contributions to the semiconductor capital equipment industry and the medical device industry. Three years ago I joined with four other engineers to fund and start up a medical device research and engineering outsourcing company (Circle Medical Devices, Inc). This has been a very successful and satisfying venture.

### Education and Career

I graduated with a B.S.E.E. from San Jose State in 1976. For a while I pursued a master's in computer engineering, but starvation forced me into the work force. This was at the time of the birth of the microprocessor. Initially I designed systems using vacuum tube technology, then discreet semiconductors, and then microprocessors and VHDL. I have used almost all of my university training during my career (OK, not cultural anthropology, but it was fun) to solve real-world problems. Statics, dynamics, thermal transport, fluid flow, AC/DC machinery, and of course electronics have all been useful.

Engineers have to be broad if they are going to be able to overcome obsolescence. My humble opinion is that a university education in engineering should just put enough tools in your tool bag to be able to learn the current technology and then tomorrow's next-generation technology. All of those physics and core courses in engineering are crucial to being continuously competent.

### Advice to Engineering Graduates

Don't wait to be told what to do on your first job. Learn what everybody is already doing. Ask questions. Reverse-engineer everything you can get your hands on. Be a pest but not a pain; contribute; and above all, enjoy.

## Stephen V. Minshew
*Vice President
Digital Phone Systems Operations
Time Warner Cable*

### Career Highlights

The most recent highlight has been in building Time Warner Cable, previously a provider of cable TV and high-speed internet services, into the seventh-largest telephone company in the nation. I started on the project as a consultant a year before our first subscriber, and now Time Warner Cable has over 2.5 million residential telephone subscribers.

Another highlight has been in building OnePoint Communications from scratch into a major voice, video, and data provider to the MDU market. Finally, the classified work I performed in Advanced Weapons Systems at Texas Instruments will always be a highlight in my life—mostly because it felt so good to do something good for my country.

### Education and Career

I wouldn't have gotten anywhere without a good education, and I received a good, solid education at SMU. I ended up with a very deep understanding of solid-state device physics and a very broad understanding of not only EE disciplines, but other disciplines such as advanced mathematics, physics, mechanics, thermodynamics, computer science, and computer engineering. The M.B.A. added credentials and credibility in the business workplace, but it was the very broad undergraduate education that has proved most useful to my professional success.

### Advice to Engineering Graduates

Find things you are interested in and learn about them—and never stop learning.

Become an expert in one discipline and knowledgeable in several others. Then find a discipline, a company, and a boss that fits you—and don't settle for any of these that do not fit.

Work harder than everyone else, and do not expect anyone to give anything to you—but be grateful to those who help you.

## Steven Ruben
*Counsel
Intellectual Property and Information Technology
WolfBlock*

### Career Highlights

Patent litigation requires managing a huge number of moving variables, including the balance of advocacy toward a broader patent (which may in turn invalidate the patent in light of prior teachings) or a narrower patent (which may mean that a defendant's product no longer infringes). My highlights include the times I have successfully generated a succinct document that can explain complex technology in simple terms and in a persuasive manner while balancing all of those variables.

### Education and Career

I use my education in electrical engineering every single day. Its breadth benefits me the most. My practice requires me to be a generalist in technology while still being able to specialize. In litigation, one patent may be the focus for years at a time. In that case, I may become close to an expert in that technology. In patent procurement, I may have only one day (or less than a day) to pick up an existing file, learn the invention, and distinguish it.

### Advice to Engineering Graduates

A degree in engineering is an incredibly powerful and impressive credential. There are many who cannot handle the curriculum and will be impressed as soon as they learn of your education. There are many career paths available for the educated engineer. Keep an open mind and never stop learning. Your worst or least favorite subject may be where the technology jobs are. College was just the start of your education. You now have the fundamental tools to attack any engineering project. There's a good chance you won't know all you need to handle your first tasks, but you will know where to begin.

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# Meet the HKN Board of Governors

Full biographies of HKN's distinguished board of governors are available on-line:
http://hkn.org/about/governance.html.
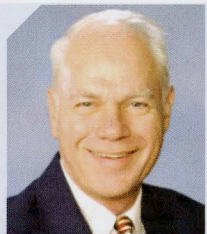
### President
**J. David Irwin,** Xi

Dr. Irwin, ECE chair at Auburn University, has been active at Auburn for most of his career. He is a fellow of the IEEE and ASEE and has served on multiple honors and educational committees with the IEEE. He has authored and co-authored numerous publications, patent applications, and presentations, including 16 textbooks.

### Vice President
**Bruce Eisenstein,** Beta Alpha

Dr. Eisenstein, ECE professor at Drexel University, is a C. Holmes McDonald Outstanding Teaching Award recipient and an IEEE fellow. He has published more than 50 papers and has lectured extensively worldwide.

### Past President
**Karl Martersteck,** Eta–Board of Directors

Mr. Martersteck's professional career includes leading mission planning and systems analysis activities for the Apollo lunar landing and Skylab projects and assuming responsibility for the design and development of the 4ESS switch at Bell Labs. He retired as president and CEO of ArrayComm and currently consults.

### Director West-Central Region
**David Soldan,** Beta Kappa

Dr. Soldan, ECE professor at Kansas State University, served as ECE department head at KSU for 15 years. He is active on the IEEE committee on Engineering Accreditation Activities. Dr. Soldan was active in the Electrical and Computer Engineering Department Heads Association (ECEDHA), serving as president from 2002–2003.

### Director West Region
**Stephen Goodnick,** Pi

Dr. Goodnick is associate vice president for research at Arizona State University. Prior to this position, he was an ECE department head and an active officer in ECEDHA. He has been a visiting faculty member at universities worldwide and has published more than 150 refereed journal articles, books, and book chapters.

### Director-at-Large
**Evelyn Hirt,** Beta Sigma

Ms. Hirt, an ESH&Q principal engineer at Pacific Northwest National Laboratory, has held a variety of positions in EE, including in project management; systems design, analysis, and testing; flight control systems; laboratory operations; and product testing. She is active in the IEEE and academia.

### Director East-Central Region
**Teresa Pace,** Eta–Board of Directors

Dr. Pace is director of engineering at DRS Optronics Technologies. Previously she worked for Lockheed Martin and the Applied Research Laboratory, focusing on the application of engineering to the field of medicine. Dr. Pace has been awarded four patents and received many awards, including HKN's Outstanding Young Electrical and Computer Engineer.

### Director East Region
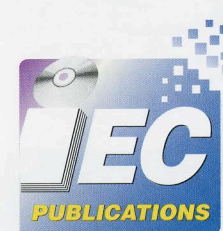**Casimir Skrzypczak,** Delta Mu

Mr. Skrzypczak was senior vice president of Customer Advocacy at Cisco Systems, and prior to that he was corporate vice president and group president of Professional Services at Telcordia Technologies and president of NYNEX Science and Technology. He currently serves on multiple boards and consults.

### Director-at-Large
**John Orr,** Alpha

Dr. Orr, dean of undergraduate studies at Worcester Polytechnic Institute, first joined WPI as the ECE department head. He served ECEDHA as an elected officer, co-authored a textbook, and is currently active in ABET and the FIE Steering Committee. His professional interests include digital processing and engineering education curriculum.

## Chapter Notes from Headquarters

We hope that your year has started off successfully. We are proud of the activities and accomplishments of the nearly 175 active HKN chapters across the United States.

Many of you have engaged underclassmen through mentoring and tutoring and encouraged high school students to pursue a degree in ECE by guiding tours of your department and campus. Some chapters have formed Relay for Life teams supporting the American Cancer Society, and many have held fundraisers for a variety of charities. At the department level, you have performed service to your classmates by hosting lecture series, organizing job fairs, and monitoring the laboratories. And don't forget the social activities! We love seeing the pictures of the IEEE/Tau Beta Pi/HKN chapter football games, dance lessons, picnics, and pizza parties.

*It is a special honor to be an Eta Kappa Nu member, and we are proud of your accomplishments!*

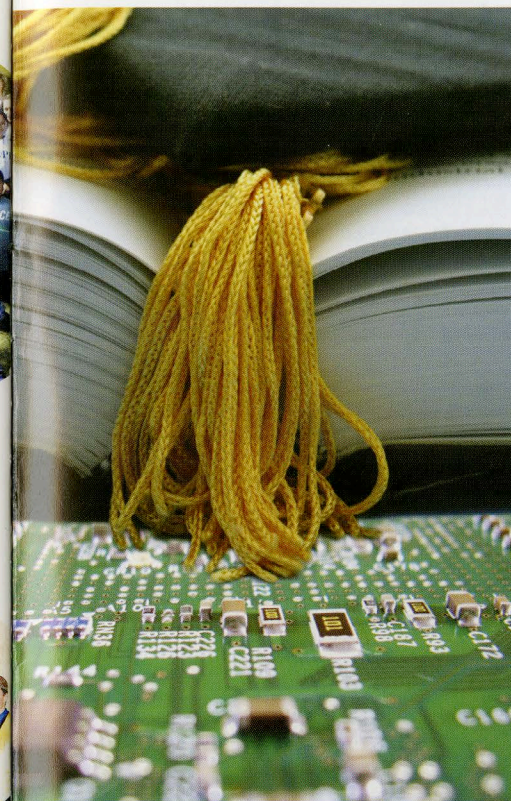### Headquarters has a few notes to share with the chapters:

- Starting in November 2008 the **IRS rules** are changing. Any chapter with gross receipts of $25,000 or more must continue to file Form 990. New next year, chapters with less than $25,000 in gross receipts must now file an e-postcard with the IRS annually. This is a short on-line form stating the chapter's contact information and confirming that the gross receipts remain under $25,000. More information will be posted at **www.irs.gov/eo**, and chapters will continue to be reminded of this new requirement. HKN could lose its tax-exempt status if chapters fail to fulfill this obligation. Chapters should contact HQ if they need their tax-ID number.

- **Requirement for membership:** All inductees must participate in the **induction ritual** in order to become members of HKN. Similarly, they are not considered members until HQ receives a completed New Member Requisition Form and processes the membership. It is important to mail the paperwork in a timely fashion so that new members receive THE BRIDGE; can register on Experience Inc., the new career database for HKN members; and enjoy the benefits of membership. If you have not received certificates for new members, you can assume HQ has not received the paperwork for new members.

- **Recruiting** is often a struggle for chapters. Here are some recruiting ideas:
  - > Send personalized letters to invitees from your department head, distinguished faculty or alumni, or advisory board member
  - > E-mail HQ a list of invitees so that Roger Plummer, executive director, can send personal e-mails encouraging invitees to join
  - > Tailor the recruiting PowerPoint presentation available on-line to meet your chapter's needs and use it at your information sessions
  - > Inform potential members of Experience Inc., the new career database offered to HKN members. It is a great benefit of membership and offers lots of articles, internships, job shadowings, interview and resume techniques, connections to other HKN members, and job postings.

*As always, please do not hesitate to contact headquarters if you ever have any questions!*

## THE·BRIDGE
The Magazine of Eta Kappa Nu

**Key Dates, Article and Profile Submissions**
> **January 15, 2008** *Deadline for submissions, Spring 2008 issue*
> **February 1, 2008** *Notification of selections for Spring 2008 issue*

### 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@hkn.org* (MS Word .doc files preferred).

### Share Your Wisdom

This issue of *THE BRIDGE* introduces 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@hkn.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.

# 2006–2007 Annual Fund Contributors

Eta Kappa Nu acknowledges and thanks its generous donors for the 2006-2007 annual contribution campaign. Through their support, attendance at the student leadership conference at Purdue University in November 2006 was offered to all HKN members at no cost. The Purdue conference was very successful and received such enthusiastic feedback that two chapters, Gamma Theta (University of Missouri, Rolla) and Mu (University of California, Berkeley), will host regional conferences in fall 2007 once again at no cost to attendees.

The HKN Web site (www.hkn.org) continues to evolve as it becomes the first place HKN members visit for chapter, member, and organizational news. The Awards Program is thriving. Since July 2006 15 Outstanding Chapters, an Outstanding Student, three Eminent Members, a Distinguished Service Award winner, and a Karapetoff Award winner have been recognized. Partnerships with the IEEE and ECEDHA, the Electrical and Computer Engineering Department Heads Association have been strengthened. A career database will be offered to all HKN members starting fall 2007. It is in direct response to the Second Century Project feedback and will help keep alumni engaged.

Our heartfelt gratitude goes out to all HKN supporters as we continue to recognize the top students, faculty, and professionals in electrical and computer engineering.

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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.

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