

THE ♦ BRIDGE

The Magazine of Eta Kappa Nu

AUTUMN 2006

Challenges for the Next Generation of Engineers

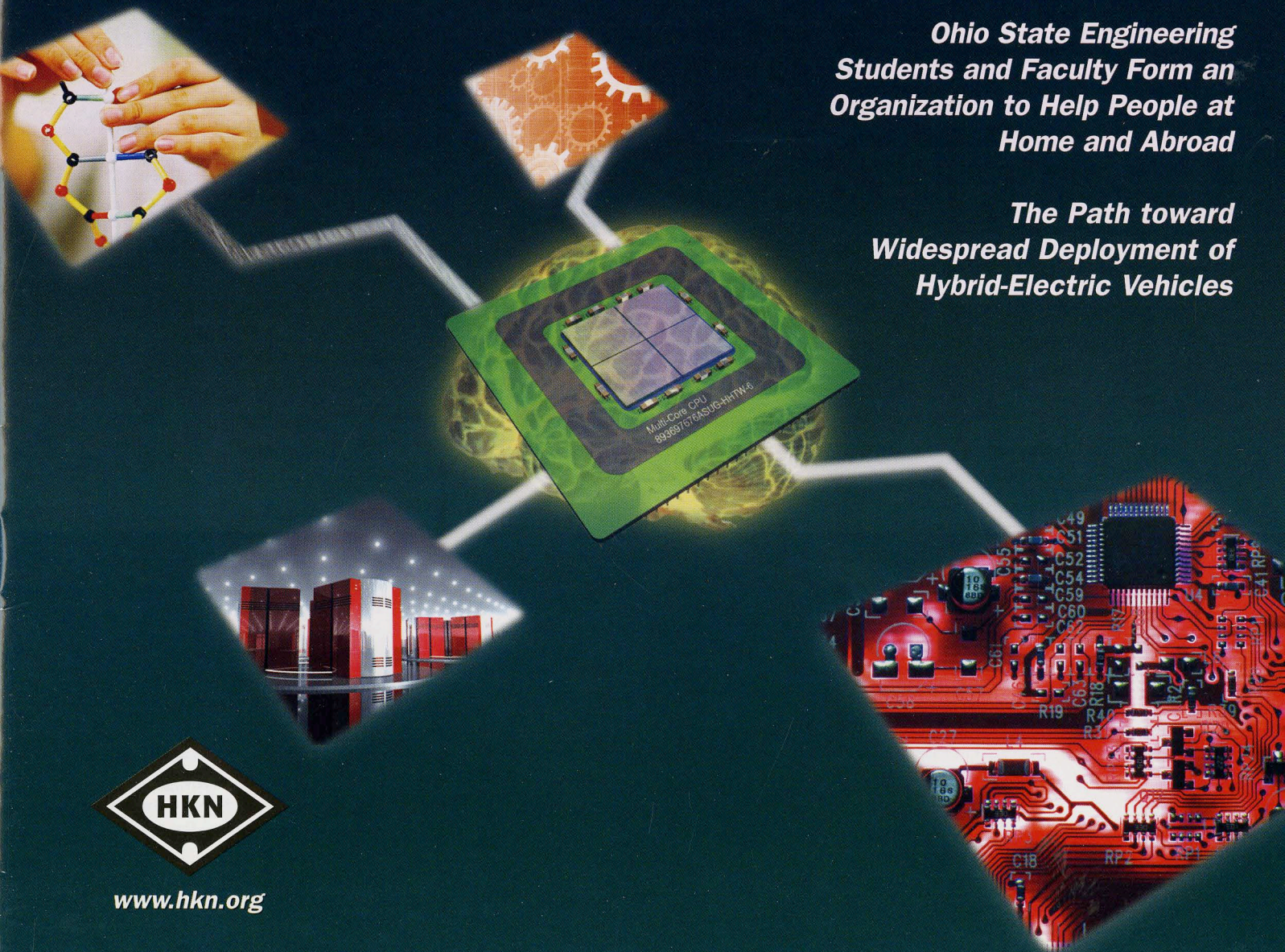
FEATURES

**Systems Engineering Design
Projects: Experiential Learning
for the Engineer of 2020**

Engineering at the Extremes

**Ohio State Engineering
Students and Faculty Form an
Organization to Help People at
Home and Abroad**

**The Path toward
Widespread Deployment of
Hybrid-Electric Vehicles**



www.hkn.org

LETTER FROM THE EXECUTIVE DIRECTOR

Roger L. Plummer

Dear HKN members,

In his letter included in the fall 2005 issue of *THE BRIDGE*, Bob Janowiak stated, "The 2005–2006 year promises to be very busy ... renewal is challenging ... necessary and rewarding." How right he was!

Membership and chapter activity for the year continues at a brisk pace. Processes have been established between headquarters staff and faculty advisors to standardize activities and improve information flow about chapter recruitment status. Each chapter received a chapter packet, which included a letter from President Dave Irwin encouraging students to accept membership. Also, faculty and graduate students are encouraged to join and letters have been sent to department chairs at six Canadian universities encouraging them to initiate HKN chapters.

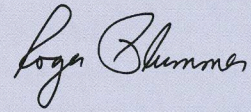
A letter detailing the results of the Second Century Project and outlining plans to address issues deemed important to students has been sent to each chapter, and implementation or expansion of programs students mentioned were important to them is under way. To respond to specific student input received as part of the project, as well as highlight the importance of the student experience, a regional student conference was held at Purdue from November 3–4, 2006. A distinguished panel of speakers, consisting of HKN alumni, was featured, including Mike Birk, founder and chairman of Tellabs, who discussed leadership.

Under the leadership of the Awards Committee, before years' end, many awards will have been conferred at venues from coast to coast, including a Distinguished Service Award, three Eminent Member certificates, a Karapetoff award, and a C. Holmes MacDonald Outstanding Teaching Award.

The 2005–2006 Contribution Campaign was a huge success. Thank-you letters have been sent to all contributors, along with a brochure listing all donors. The 2006–2007 campaign is already under way.

2005–2006 has indeed been a busy, challenging, and rewarding year. We look forward to the coming year and the opportunities it will bring.

Warm regards,



LETTER FROM THE EDITOR

Barry J. Sullivan | Beta Omicron Chapter Member

The next generation of electrical and computer engineers will face challenges unlike those of previous generations. While each generation must confront technical challenges unique to its time, the changing nature of the profession will present greater challenges of a nontechnical nature than ever before.

The articles in this issue of *THE BRIDGE* provide a sampling of the range of challenges for those who will practice engineering in the 21st century. The first article, by Richard Schultz, addresses the challenge of developing the nontechnical skills required of engineers as it describes systems engineering design projects at the University of North Dakota.

Kelly Kozdras found environmental and cultural challenges in Antarctica and Honduras, which she relates in her article on a pair of opportunities she has been able to pursue early in her career. In a similar sense, the article by Richard Dzwonczyk places engineering in a cultural context, describing the work of a student organization at The Ohio State University to deliver engineering solutions to disadvantaged communities both locally and internationally.

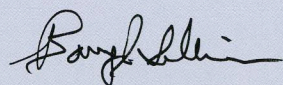
Finally, Elizabeth Johnston demonstrates the need for engineering expertise in developing public policy as she reports on her study of advanced vehicle technology as a Washington Internships for Students of Engineering (WISE) intern. Steve Watkins provides a description of the WISE program and a link for more information at the end of this article.

All of these articles present examples of the nontechnical challenges the next generation of engineers will encounter. They also demonstrate that the rewards of a career in engineering includes more than the satisfaction of technical achievement.

Please visit the Eta Kappa Nu Web site, www.hkn.org, where you will find supplemental material for all of the articles appearing in *THE BRIDGE*. You will find chapter news and society announcements posted there as well.

Feedback on *THE BRIDGE* is always welcome. You can reach me via e-mail at editor@hkn.org.

Warm regards,



Eta Kappa Nu

The Electrical and Computer
Engineering Honor Society

Founded October 28, 1904

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Eta Kappa Nu (HKN) was founded by Maurice L. Carr at the University of Illinois on October 28, 1904, to encourage excellence in education for the benefit of the public. HKN fosters excellence by 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 attainments.

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THE BRIDGE

The Magazine of Eta Kappa Nu

features

6 Systems Engineering Design Projects Experiential Learning for the Engineer of 2020

Employers expect the next generation of entry-level engineers to exhibit the ability to work on multidisciplinary teams, communicate effectively, and engage in lifelong learning. Large-scale systems engineering design projects develop the skill set to meet this challenge.

8 Engineering at the Extremes A First-Person Account of Engineering Adventures

A young engineer finds professional challenges and personal satisfaction working in two remote locations—Antarctica and rural Honduras.

12 Ohio State Engineering Students and Faculty Form an Organization to Help People at Home and Abroad

Students address the challenges of developing lifelong professionalism, volunteerism, and global broad-based thinking by conducting local and international mission projects that require engineering and technology.

14 The Path toward Widespread Deployment of Hybrid-Electric Vehicles An Engineering Internship in Public Policy

Hybrid-electric vehicle (HEV) technology is an advanced vehicle technology that has the potential to displace oil use, but policy decisions must be made to encourage the deployment of this technology. An engineering intern finds challenges in the public policy arena.

departments

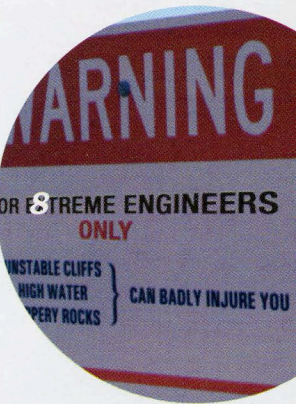
16 HKN Chapters in Action

18 2005–06 List of Donors

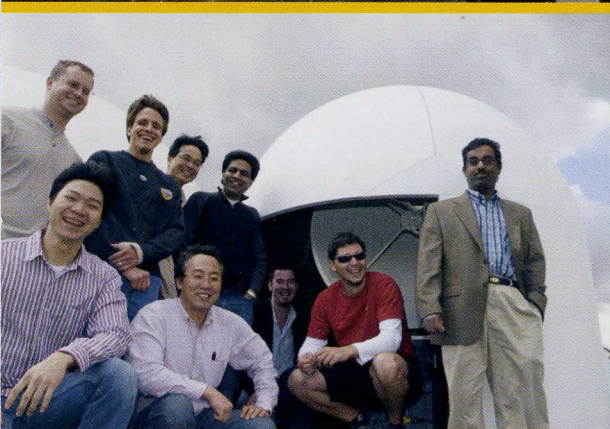
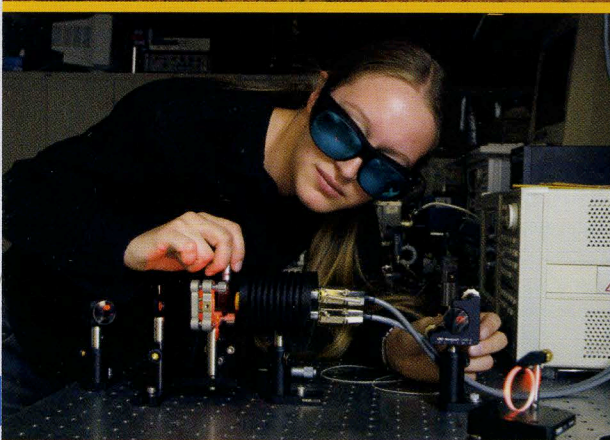
award winners

5 OYECE Award

10 HKN Welcomes New Eminent Members



Discover



Colorado State University

The Department of Electrical and Computer Engineering can connect you with world-class research and proven people in an unbeatable setting.

Cutting-Edge Research and Facilities - Standing apart from other departments, our electrical and computer engineering program was awarded two Engineering Research Centers by the National Science Foundation.

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Colorado
State
University

New HKN Chapters and OYECE Award

Western Michigan University



WESTERN MICHIGAN UNIVERSITY

Chapter Name
Kappa Omega

Date of Induction
April 5, 2006

Number of Inductees
11



Kappa Omega inducted 11 charter members at a ceremony on April 5, 2006. Karl Martersteck, who was then president of HKN, conducted the ceremony in the beautiful new engineering facility at Western Michigan University. The installation was well organized, and several guests, including parents, friends, faculty, and the dean of Engineering were able to attend. ECE Department Chair Dr. John Gesink and new Faculty Advisor Dr. Ralph Tanner were also inducted. After the ceremony, everyone celebrated at a local restaurant. Their motto is, "We aim to better our university, community, and fellow peers by using applied engineering and dedicated work ethics."

University of West Florida



Chapter Name
Lambda Alpha

Date of Induction
April 22, 2006

Number of Inductees
17



Lambda Alpha's 17 charter members were inducted on April 22, 2006, by Dave Irwin, who was then vice president of HKN. Because the University of West Florida has two campuses—one at Pensacola and one at Fort Walton Beach—the ceremony was held halfway between the two at Navarre Beach. Their two faculty advisors—Dr. Dale Harrell from Pensacola and Dr. Tom Gilbar from Fort Walton Beach—were present and helped with the ceremony. Dr. George Ellenberg, associate dean of Arts and Sciences, was their guest of honor and accepted the charter during the installation ceremony. Following the ceremony, the group celebrated with a light lunch.

Outstanding Young Electrical and Computer Engineer Award – 2005

This award shall be given annually to a young electrical and computer engineering graduate for meritorious service in the interests of humankind as evidenced by his or her past record and future promise, as well as for outstanding achievements in his or her chosen profession.

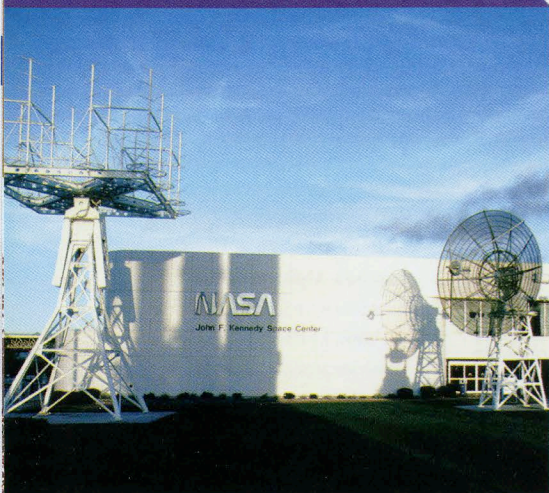
AWARD WINNER



Karen Miu Miller

Associate Professor, Electrical and Computer Engineering Department
Drexel University

Dr. Miu Miller was named the Outstanding Young Electrical and Computer Engineer for her work on the analysis of power distribution systems and the development of analytically based power distribution application functions. Her work is providing new methods to evaluate economic tradeoffs in the engineering decisions required in planning new systems, as well as technical direction to the issues of customer demand flexibility and the associated economic advantages of elastic loads. She was also recognized for her contributions as an educator at Drexel University, where she has developed several new courses in power, energy, and control systems incorporating active and hands-on learning in the classroom and laboratories.



Systems Engineering Design Projects: Experiential Learning for the Engineer of 2020

by Richard R. Schultz

Multidisciplinary teamwork. Effective communication skills. An ability to engage in lifelong learning. EAC/ABET expects these outcomes in all of our students, while the employers of our graduates have grown to require them in the next generation of entry-level engineers. Offering undergraduate and graduate students opportunities to take part in large-scale systems engineering design projects at the University of North Dakota (UND) over the past six years has been a tremendous way of training students not only in fundamental engineering analysis and design techniques, but also in project management, system integration and testing, and standards. These team-oriented projects require electrical, mechanical, and software engineering expertise, and they provide both in-class and extracurricular

experiences that are as close as possible to the "real world" of engineering design that depends on the understanding of an entire system, from concept to operations. In essence, this is workforce development for the engineer of 2020, which includes a systems engineering skill set desired by almost every corporation and R&D laboratory that recruits our electrical engineering graduates today.

The Science of Space

In the UND School of Engineering & Mines, we have been extremely fortunate to partner with the John D. Odegard School of Aerospace Sciences on our campus. UND Aerospace offers one of the top baccalaureate aviation programs in the world, with a new master's program educating the next generation of aviation researchers and policymakers. Since the start of the millennium, the electrical and mechanical engineering departments have partnered with UND Aerospace faculty to develop several environmental remote sensing payloads and platforms.

These sensor development efforts have fostered a systems engineering culture in UND's electrical and mechanical engineering departments in which

undergraduate and graduate student teams, led by faculty mentors, design, build, and test remote sensing instruments based on actual end-user requirements. These scientific sensors consist of sophisticated electronic, mechanical, and software subsystems, which require the students to make a multitude of "build versus buy" design decisions, as well as develop and execute extensive system integration and test protocols prior to deployment. Furthermore, the faculty, staff, and students have been involved in both Federal Aviation Administration (FAA) and National Aeronautics and Space Administration (NASA) certification processes to ensure safety in all aspects of payload integration and operation.

From these experiences, a niche has surfaced for the UND School of Engineering & Mines in small unmanned aircraft system (UAS) payload development and unmanned aerial vehicle (UAV) modifications to conduct sense-and-avoid and synthetic vision research. As an initial small UAS payload development and demonstration effort, undergraduate electrical and mechanical students are designing a thermal-optical digital imaging system to be flown on an experimental aircraft built by Lockheed Martin Corporation. The custom payload will be able to perform a broad range of civilian and environmental applications, including firefighting, disaster response, and precision agriculture.

The custom design represents an end-to-end system, including electro-optical (EO) and uncooled thermal infrared (IR) remote sensing capabilities, navigation sensors and receivers to sample payload position, onboard data processing, and wireless data streaming to a mobile ground control station. This EO/IR digital imaging payload offers a complete range of remote sensing capabilities for both daytime and nighttime flight operations. The infrared camera is an uncooled,

microbolometer-based thermal imager, providing state-of-the-art reliability. Each camera in the thermal-optical imaging system is mounted on a 360-degree horizontally rotating, 30-degree vertically rotating precision pointing system. This added camera adjustment feature allows each sensor to assume various orientations, enabling continuous pointing on a given target as the UAV loiters in a circle flying overhead.

As far as the direct benefits to the students involved in these inherently multidisciplinary design projects are concerned, first and foremost they receive training as systems engineers, which is vitally important for the modern tech-savvy workforce. The participants also have a chance to practice their communication and teamwork skills, so they are better prepared for their future careers. The most important lessons that the students take away from these systems engineering design projects include the following:

- > *Documentation is critical*, especially for long-term (i.e., multiple academic year) projects in which the student workforce turns over every semester.
- > *Designing subsystems is relatively easy*, but designing their interfaces is significantly more difficult because of coordination and teamwork issues. The need for accurate interface control documents and excellent oral and written communications among team members becomes more and more crucial as the design team grows.
- > *System integration and test always takes much longer than you expect in any real-world design project*, so you must plan your timeline accordingly. In particular, electromagnetic compatibility is extremely important in the integration of electronic payloads into GPS-navigated vehicles.



Figure 2

Unmanned aerial vehicle electro-optical and uncooled thermal infrared digital imaging payload undergoing electromagnetic interference (EMI) testing at the Lockheed Martin Corporation EMI test chamber in Eagan, Minnesota.

* Photo courtesy of Raymond J. Johnson, staff engineer, Lockheed Martin Corporation.

Learning about the regulatory process, which has included the FAA for airborne payloads and NASA for payloads developed for launch and operations in NASA space vehicles, is extensive and time-consuming. It is also one of the most sought-after experiences by potential employers.

What does the future hold? Certainly, there will be continued efforts at the University of North Dakota to design, build, test, demonstrate, and operate small UAS civilian and military payloads, as well as other payload/vehicle modifications to provide precision sensor pointing, sense-and-avoid, synthetic vision, and ultra-reliable communication capabilities for autonomous systems. With new UAV missions

assigned to the Grand Forks Air Force Base (20 miles west of the UND campus) and the Air National Guard wing in Fargo (70 miles south of Grand Forks), a U.S. Border Patrol Station based in Grand Forks that is responsible for monitoring 917 miles of the U.S./Canadian border extending from the Great Lakes to well into Montana, wide-open skies available for field tests and flight operations, and a northern climate for the cold weather testing of aircraft platforms and sensors, the geographic location of the University of North Dakota is ideal for establishing a Center of Excellence in Unmanned Aircraft Systems.

Conclusion

Most recently, federal and state government funding as well as corporate support has been flowing into the University of North Dakota for research, education, and training related to UASs. This type of university/industry/government partnership is exactly what U.S. Senator Byron L. Dorgan from North Dakota had in mind when he established the Red River Valley Research Corridor to attract research funding and science and technology firms to the state. Technology-based economic development in UASs is a step forward in diversifying the regional economy and recruiting new and experienced engineering professionals to the Northern Great Plains, which has had a serious outmigration problem for its most highly educated and talented college graduates.



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

ABOUT THE AUTHOR



Richard R. Schultz

Associate Professor and Chair of Electrical Engineering,
University of North Dakota
Delta Rho chapter – University of North Dakota

Dr. Schultz received his B.S.E.E. degree from UND in 1990 and his M.S.E.E. and Ph.D. degrees from the University of Notre Dame in 1992 and 1995, respectively. He joined the UND faculty in 1995. His teaching and research interests are aerospace payload and sensor development, embedded systems design, signal and image processing, student-generated intellectual property, systems engineering, and technology entrepreneurship. Dr. Schultz has co-taught a multidisciplinary opportunity identification course with UND's entrepreneurship director for the past several years. In 2001, he received the HKN C. Holmes MacDonald Outstanding Teaching Award.

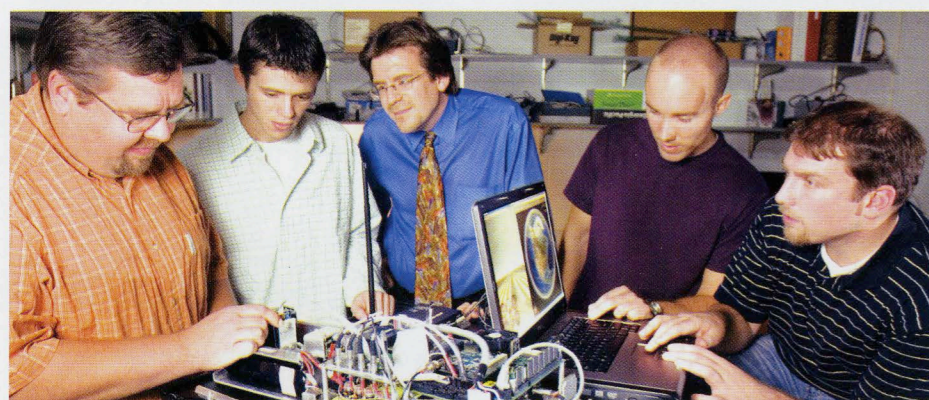


Figure 1

Electrical and mechanical engineering students and faculty debug the UAV payload electronics and mobile ground station software.

From left to right: Dr. William H. Semke, associate professor of mechanical engineering; Samuel Trandem, senior in mechanical engineering; Dr. Richard R. Schultz, associate professor of electrical engineering; Brian Berseth, senior in electrical engineering; and Matthew Lendway, junior in electrical engineering.

* Photo courtesy of Chuck Kimmmerle, university photographer, University Relations, University of North Dakota.



Engineering at the Extremes

by Kelly Kozdras

livable for a range of people. I have found an interesting pocket of experiences as an electrical engineer that have allowed me to fulfill some of these interests without leaving the field, as some intended when they said that engineering is a good “background.”

One of the first opportunities came in a form I would not have predicted—I was offered a one-year contract by Raytheon Polar Services Company to work as an on-site electrical engineer at the National Science Foundation’s South Pole Station. Before this, I had been working as an electrical engineer in the Capital Projects of MTA New York City Transit, but had on and off been looking for work overseas that meshed with some of my goals and interests. The chance to work at a scientific research station—and to help in the construction of a new station there—seemed like a great place to start. I had heard vague stories of work in Antarctica, and it seemed like an extreme example of seeing one of the completely different lifestyles and landscapes that the earth has to offer. I decided to make the switch from the subway tunnels of Manhattan to the snow tunnels of the South Pole. The year passed in Antarctica, with highs and

lows—with great celebrations and beautiful displays of the aurora australis, and with the occasional cranky and tired neighbor showing the signs of a long winter. When the LC-130s returned to us in October 2005, I was tired in many ways and was excited to see the engineers returning who I had worked with the previous summer. One afternoon I walked around with one of them, showing him all of the work we had completed in construction during the eight months since he had last seen the station. For that afternoon, my energy certainly picked up a bit. The challenges to construct in Antarctica are considerable—materials transport, conditions of outside work, fatigue of the crews during the winter, communication challenges with the United States, just to begin the list. To see through his eyes the progress that we made during these eight months was remarkable, as it highlighted the fact that we met these challenges head-on and produced something that will be around for a while in such a unique place.



Figure 1 Kelly Kozdras at South Pole Station during the austral summer.



Figure 2 Water treatment plant in Ojojona, Honduras, during construction with many of the local workers and one of the American engineers who worked on the project.

Working in Antarctica allowed me, along with many of my colleagues there, a great opportunity to develop savings to fulfill whatever interests we might have back home. My interest was volunteering overseas, and I finally had the time and money to pursue that. I did not have to look far. I applied and was accepted for a summer program sponsored by Engineers for a Sustainable World (ESW), which has university students and professionals working on engineering projects in developing countries around the globe. I was assigned to assist with the construction of a water treatment plant project in Ojojona, Honduras, a small village about an hour from the capital city. While my electrical engineering background would not be directly used, my knowledge of construction, the Spanish language, and general engineering education would be beneficial.

My experience in Honduras was at times frustrating, entertaining, and in the end, very rewarding. Our goal was to oversee the construction of the treatment plant and train the future operators of the plant in its

functionality and use. In retrospect, I do not believe we ever strayed far from that goal, and in the end achieved it. However, we often became caught by the minute stresses of the day, issues such as the language barrier or the slowness of transporting materials to our construction site. We had a celebration our last night in Ojojona, and awards and congratulations were given all around. The sincerity in the eyes of the people in the town and on the water board as they thanked us individually and as a group

registered for me. It became obvious that while these types of projects often have more day-to-day frustrations than work in our home country, they can also ultimately have so much more reward, as the needs being fulfilled are much more basic and greater in some of these communities. I saw firsthand that our education can provide so much assistance around the world when directed toward well-meaning and well-planned projects.

Conclusion

Much of working life certainly is a bit less dramatic than these experiences. Engineers are often rather passionate about their work, and with good reason. We are regularly interacting with a world that is fascinating and are pushing the limits to expand our capabilities in that world. I have been lucky to see some exciting examples of that, which confirms my suspicion that engineering is indeed more than just a good “background.”



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

ABOUT THE AUTHOR



Kelly Kozdras
Epsilon Eta chapter – Rose-Hulman Institute of Technology

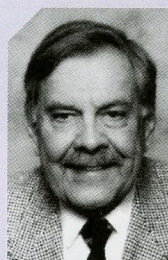
Ms. Kozdras began her career with AmeriCorps in Denver, Colorado, and then worked with the MTA New York City Transit as an electrical engineer. She served as electrical engineer at South Pole Station, Antarctica, working on construction and facility issues, and recently spent the summer as a volunteer for Engineers for a Sustainable World. In addition, she served as an engineering mentor for all-girls high school competing in FIRST Robotics Competition. Ms. Kozdras is active in the Society of Women Engineers.

Two New Eminent Members Inducted

Eta Kappa Nu confers Eminent Member status, the society's highest level of membership, on 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 June 2006



Harry W. Mergler

Harry W. Mergler's legacy includes not only the 151 master's and 48 doctorate students who earned their degrees under his guidance, but also two dozen patents, all of which have found active industrial application. He distinguished himself as an educator over more than three decades at Case Institute of Technology and Case Western Reserve University, with half of that time as the Leonard Case Chair in Electrical Engineering. At the same time, the citation for the 1978 IEEE Lamme Medal recognizes him "for pioneering research and creative industrial application of digital technology to machine tool and industrial control systems." Professor Mergler's teaching and research also included digital logic design as applied to embedded control networks in aeronautical instrumentation, and he wrote the book *Methods in Digital Logic Design*. His career exemplifies the ideal of the engineering professor as an accomplished practitioner as well as a teacher and mentor for future engineers.

Mergler at a Glance

- > Leonard Case Chair in Electrical Engineering, 1978–89
- > Elected as a fellow of the IEEE in 1976, and a member of the National Academy of Engineering in 1980
- > Awarded the IEEE Lamme Medal, Case Institute of Technology Gold Medal, IEEE Centennial Medal, and IEEE Best Paper Award
- > Member, Zeta Chapter
- > B.S. in electrical engineering from Massachusetts Institute of Technology and Ph.D. from Case Institute of Technology

EMINENT MEMBER

Presented June 2006



Tsuneo Nakahara

Tsuneo Nakahara's career as a global industrial leader and engineer in wire and cable industries has spanned more than 50 years. Since joining Sumitomo Electric Industries, Ltd., in 1953, Dr. Nakahara has been a major force in the conception, design, and manufacturing of optical fiber and cables. Under his guidance, the company developed the vapor phase axial deposition optical fiber manufacturing technology, which has become the standard in Japan and is one of the top three fiber-manufacturing processes worldwide. His team also designed extremely low-loss optical fiber with pure silica as the core and fluorine in the clad. This technology was widely used for undersea long-distance cables. He also has been a leader of important research into multi-count optical fiber, leaky coaxial cable, milliwave and beam waveguide, and more. Dr. Nakahara holds nearly 300 patents in the United States and Japan combined and has published more than 100 papers.

Nakahara at a Glance

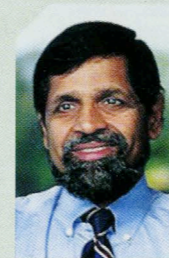
- > Former executive vice president and vice chairman, Sumitomo Electronics
- > Member of the Board of Trustees, Polytechnic University
- > IEEE Life Fellow, foreign associate member of the U.S. National Academy of Engineering
- > Recipient of the IEEE Alexander Graham Bell Medal, Takayanagi Medal, IEEE Third Millennium Medal, the Okabe Memorial Award from the Institute of Electronics and Communications Engineers of Japan, and the Blue Ribbon Medal from the emperor of Japan
- > Ph.D. in electrical engineering from the University of Tokyo

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 electrotechnology resulting in significant benefits to humankind.

AWARD WINNER

Presented September 2006



Arun N. Netravali

Arun N. Netravali is regarded as a pioneer in the field of digital technology and led numerous initiatives, including Bell Labs' high-definition television (HDTV) effort. He also holds more than 75 patents in the areas of computer networks, human-machine interfaces, picture processing, and digital television. While his technical achievements are the basis for his selection for this award, he has made significant contributions as a business leader and educator as well. He is a founder and managing partner of OmniCapital, a private equity firm based in Massachusetts and New Jersey, and a former president of Bell Laboratories. Dr. Netravali has taught at the Massachusetts Institute of Technology, City College (New York), Columbia University, and Rutgers University. He has served on the editorial boards of several journals, was a trustee of the New Jersey Institute of Technology, and serves on the Boards of Level 3 Communications and Agere Systems.

Netravali at a Glance

- > Leader in the development of HDTV and MPEG standards
- > Wrote more than 180 papers and co-wrote three books
- > Former president of Bell Laboratories
- > Fellow of the IEEE and AAAS; member of the National Academy of Engineering; and winner of the Alexander Graham Bell Medal, Emmy Award, and the National Medal of Technology
- > B. tech degree from India Institute of Technology and M.S. and Ph.D. from Rice University

HKN Distinguished Service Award

Awarding esteemed recognition to at most one individual annually, the Distinguished Service Award honors those who have made significant contributions to the HKN society throughout their lifetime.

AWARD WINNER

Presented August 2006

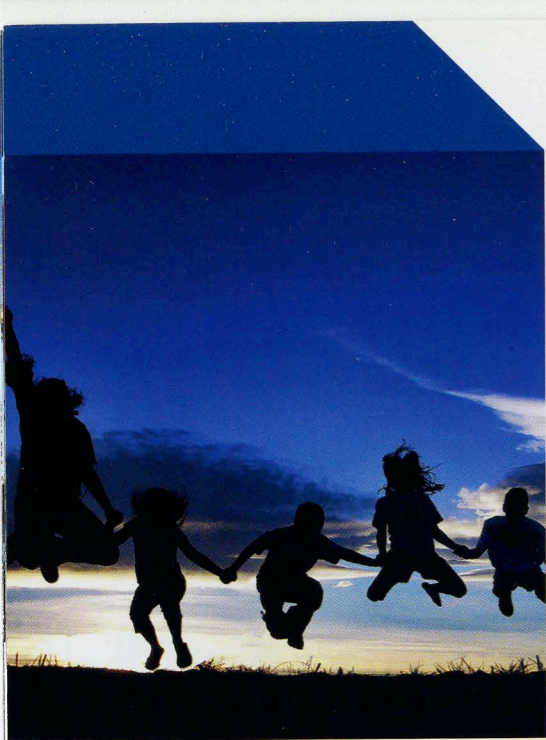


Quayne G. Gennaro

Quayne Gennaro has served on the Outstanding Young Electrical Engineer (now the Outstanding Young Electrical and Computer Engineer) committee since 1972, where she has championed women and minority candidates. She served as a director of HKN from 1975–76. Through her contacts at the White House, Ms. Gennaro was able to obtain a letter of congratulations for the OYEE/OYECE winner from the president of the United States. Since 1999, she has also arranged to have the recipients receive a flag flown over the U.S. Capitol. Although unable to attend committee meetings, she still arranges the presidential, senatorial, and congressional recognitions and flag presentation. An accomplished pianist, she has performed at many HKN ceremonies and has never wavered in her enthusiasm for HKN in her 34 years of continuous participation.

Gennaro at a Glance

- > Former president of the New York Alumni Chapter
- > HKN Board of Governors (1975–76)
- > Member, Beta Alpha chapter
- > B.S. in electrical engineering from Drexel University



Ohio State Engineering Students and Faculty Form an Organization to Help People at Home and Abroad

by Roger Dzwonczyk

contemporary issues, the global and societal impact of engineering solutions, sustainability, and economics. In three years the organization has grown from a handful of students and one professor to more than 200 active student members and 10 faculty advisors from all engineering disciplines at Ohio State.

Reaching Out

ECOS's current international mission involves Montaña de Luz, an HIV orphanage in a rural region of Honduras, 50 miles east of the capital, Tegucigalpa. During Ohio State's 2005 and 2006 spring breaks, about 15 ECOS students traveled to the orphanage for a week to help improve the operation of the facility. The trips culminated many months of preparation, planning, research, and design to solve specific issues at the orphanage. In 2005, the students set up a computer lab for the children in what was once a morgue, now, thankfully, unneeded because of the improved medical treatment the children received. The students installed used computers that they refurbished and transported from Columbus to the orphanage. They installed Spanish-language operating systems and educational software that were either purchased through fundraising or donated by software companies. The students rewired the computer lab with power, lighting, fans, and air conditioning. The students mapped out the power distribution system of the orphanage and made many modifications to the system that improved the safety of the power system for the children and workers at the orphanage. From the analysis of the electrical system, the students balanced loads on the circuits and made recommendations on ways to reduce the electrical energy cost, which is a major part of the operating budget of the facility.

A major concern of the orphanage is communications. Currently there is no landline telephone service to this remote part of Honduras. Communications in this mountainous region of the country is accomplished with an unreliable and costly cell phone system. ECOS

students have partnered with Ohio State's information technology department and designed a satellite communications system that, when installed, will provide high-speed internet access and a reliable voice-over internet communications system for the orphanage and perhaps for the entire local community as well. This past spring, the students and the local people poured a 40" x 8' x 8', 32,000-pound concrete pad to support the satellite dish. The concrete for the pad was completely hand-mixed and poured in 100° F temperatures.

Future projects on tap for the orphanage include improving drainage for the dirt road leading to the facility. This road is impassable during the rainy season. Several students are investigating the possible use of alternative electric power (wind or solar power) generation to help further reduce the cost of electric energy. This past spring the students installed equipment at the orphanage to automatically collect information on wind velocity and solar light intensity in order to determine the feasibility of alternative electric power. In addition, ECOS students plan to install the equipment for the satellite communications system once the satellite is in place.

In the course of its work in Honduras, ECOS has established a working relationship with Universidad Zamorano, the premier agricultural university in Central and South America. The students have toured the university during their spring break visits and have shared a lot of ideas about sustainable technology for the country. Universidad Zamorano has been instrumental in guiding ECOS in developing the planned communications system for Montaña de Luz.



Figure 1

Ohio State electrical engineering graduate student Jorge Finke, a fluent Spanish speaker, teaches a child how to use one of the new computers in the computer lab at the Montaña de Luz orphanage in Honduras.

Participation Spreads

ECOS's work with Montaña de Luz has ignited great interest on the Ohio State campus. This past spring break, students from the College of Human Ecology joined ECOS in Honduras and set up a library and learning center for the children at the orphanage. These students took the opportunity to sit in on classes in the village schools and speak with the Honduran educators in order to formulate useful strategies for supporting the children's educational needs at the orphanage and in the village. Several ECOS advisors and students also visited the local medical clinic in the village with hopes of establishing a relationship between the clinic and the Ohio State College of Medicine's Global Health Initiative program. This program is designed to allow medical students and medical faculty to intern at international venues to gain valuable insight into global health issues while assisting in health care in various regions around the world. Ohio State's Office of International Education has partnered with ECOS by providing much of the funding for the 2006 Honduran mission trip. Additional funding for ECOS's local and international mission projects has come from the general

engineering course that focuses on international service learning, project planning, and problem solving in a developing country. In the course, students identify specific problems and needs at the Montaña de Luz orphanage and in the village and then form teams to research, plan, design, and develop schemes to solve the problems. The teams implement their solutions on their spring break trip. The course allows the students to develop a clear understanding of the challenges, how-tos, and rewards of introducing new, appropriate, sustainable technology to a developing country.

Conclusion

The enthusiasm and support for ECOS on the Ohio State campus has been outstanding. ECOS has provided students an important hands-on facet of engineering education not necessarily afforded in the typical engineering curriculum. The students are better prepared for their careers and more enlightened about our world's technological needs because of their ECOS experiences. ECOS plants the seed of volunteerism and global service in the students that, hopefully, will grow throughout their personal and professional life.



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

ABOUT THE AUTHOR



Roger Dzwonczyk

Clinical Associate Professor, Department of Anesthesiology, The Ohio State University
Gamma Beta chapter – Northeastern University

Roger Dzwonczyk received his engineering education at Northeastern University and Ohio State. He has authored 40 journal publications and received nine patents in cardiopulmonary resuscitation, sleep apnea, and myocardial electrical impedance technology. He has served extensively for the medical relief organization Project HOPE, helping solve electrical and clinical engineering problems in many hospitals in developing countries around the world. He is the son of Larry Dwon, past president and 70+ year active member of HKN.



The Path toward Widespread Deployment of Hybrid-Electric Vehicles

by Elizabeth T. Johnston

battery to supply the extra power required under peak loads. The battery is recharged by energy recovered during the braking process. Hybrid systems allow a much smaller engine to operate at peak efficiency for a greater percentage of the drive time, getting an additional boost from the battery when necessary.

The much-lauded hydrogen economy is not right around the corner, and a lot of research and development needed for that transition can be obtained through continued improvement of HEV technology. The attitude that hydrogen technology is our ultimate goal and that we should leapfrog our development efforts will only shortchange the immediate benefits of existing technologies and their immediate fuel-saving benefits.

The early-adopter portion of consumers is important in establishing the market share of new technologies. Current government tax incentives are excellent ways to encourage these consumers. Congress passed HEV tax credits through 2009 in the 2005 Energy Bill. This will encourage a greater number of early adopters to take advantage of the tax savings offered

by HEVs. We should also encourage vehicle research and development, reformation of efficiency standards, and encouragement of government fleet purchases of HEVs.

Regardless of what other measures are taken to improve fuel economy, we must reform the loopholes in the current fuel efficiency regulatory system. SUVs and light trucks are allowed an average fuel economy of only 20.7 mpg—25 percent lower than the new car standard. An upper weight limit on which trucks are counted toward a manufacturer's overall average fuel economy has the negative effect of encouraging manufacturers to make vehicles heavier than the 8,500-pound cutoff in order to escape having these vehicles count against their average fuel economy. These loopholes have resulted in decreased SUV efficiency at a time when their market share is increasing faster than any other class of vehicle.

The Energy Policy Act of 1992 (EPA), P.L. 102-486 established fleet requirements for governmental agencies and utilities. Unfortunately, this law was made before the public offering of HEVs, some of the most efficient and cleanest vehicles. As a result, it provided no incentive for fleet buyers to purchase HEVs. This should be updated to require the purchase of HEVs instead of alternative-fuel vehicles (AFVs), which may never run off alternative fuels due to a lack of local alternative-fuel availability.

Figure 1 is a graph of the range of estimated direct net benefit of various fuel substitution options in 2001 U.S. dollars.

The estimated direct net benefits calculation includes the incremental costs of new technologies, loss of government revenue from reduced fuel sale, savings from reduced fuel use, reduction in the external costs of petroleum dependence, and savings from avoided damages by reducing pollution.

Hybrid vehicles have the highest potential positive impact of all of these technologies in the 2002–2030 time frame.

The remaining pathways will each require technology advances and strong government action to succeed.

Conclusion

These policy recommendations will help free the United States from foreign oil dependence. On the way to a hydrogen economy, HEVs will provide opportunities for technological advancement. In the meantime, their increased efficiency will decrease U.S. oil use and raise awareness of advanced-technology vehicles. The lessons learned from America's transition will be shared with other developing countries, which will be able to leapfrog their development past the early petroleum age and begin developing more efficient technologies immediately.

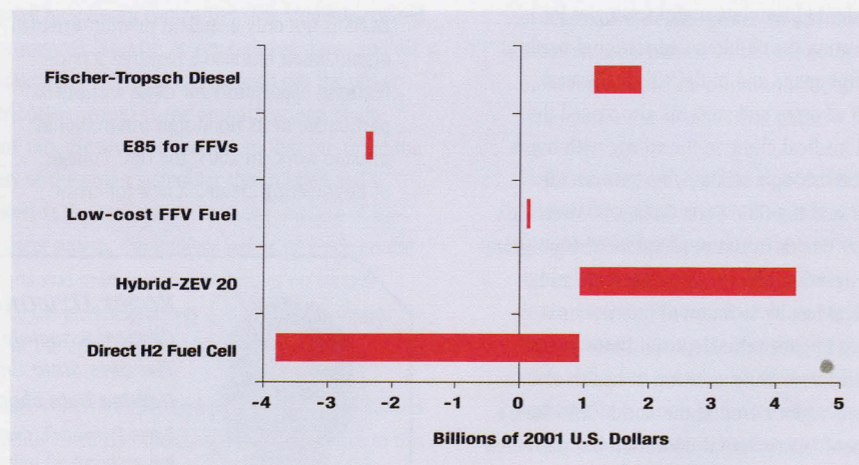


Figure 1 Range of Estimates for Cumulative (2002–2030) Direct Net Benefit of Fuel Substitution Options

Engineering Internships in Public Policy

by Steve E. Watkins, University of Missouri-Rolla, 2006 WISE Faculty-Member-in-Residence

The Washington Internships for Students of Engineering (WISE) program is an educational opportunity for engineering undergraduates in science and technology (S&T) public policy. Third-year students are selected through a national competitive process for a paid summer in Washington, D.C. The program includes mentoring activities on issues of engineering and public policy, interactive meetings with leaders in

government and policy organizations, and student research on an engineering-related policy issue. This collaborative effort among several sponsoring engineering societies has been operating since 1980. Currently, eight students participate each year with sponsorships from the American Association of Engineering Societies, Institute of Electrical and Electronics Engineers (IEEE), Society of Automotive Engineers, American Nuclear Society, American Institute of Chemical Engineers, and American Society of Mechanical Engineers.

The objectives of the WISE program are to teach students how S&T public policy decisions are made, show students how engineers can contribute to legislative and regulatory decisions, and guide students on an independent research project related to their sponsoring society. The schedule has private visits with staff from congressional committees, administrators in executive agencies, reporters of the Washington press, members of lobbying organizations (including engineering groups), and other policy leaders. Highlights of the 2005 program included meetings with NAE President William Wulf, OSTP Associate Director Richard Russell, DOE Deputy Secretary Clay Sell, ANSI Vice President Dave Karmol, and 9/11 Commissioner Peter Lyons. The student research results in an analysis paper published in the on-line *Journal of Engineering and Public Policy* and presented to the sponsoring societies. The 2005 presentations were in the House of Representatives Science Committee Hearing Room. Information on the program and student papers in the on-line journal are available at www.wise-intern.org.

The WISE program offers benefits for the participating students and the engineering community. For S&T policy to reflect an engineering perspective and to be based on accurate technical value judgments, the professional community must take the initiative as sources of information, constituents, and policymakers. The WISE students are groomed as potential leaders in the engineering profession who are aware of and can contribute to the important intersections of technology and public policy. The career paths and professional activities of many student participants are strongly influenced by their WISE experiences. The IEEE typically sponsors three electrical and computer engineering students each year. Student applications are due every fall for the following summer.



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

ABOUT THE AUTHOR

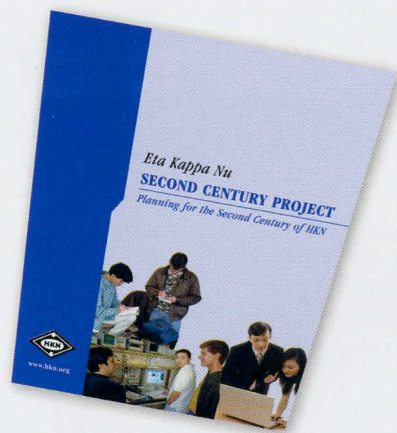


Elizabeth T. Johnston

2006 WISE Intern, University of Alaska, Fairbanks

Elizabeth Johnston is an electrical engineering and Russian studies undergraduate at the University of Alaska, Fairbanks (UAF), graduating in December 2006. She is active in the IEEE, serving as chair of the UAF IEEE Student Branch and as the Regional Student Representative for IEEE Region 6. In addition to her IEEE-USA-sponsored internship in the 2005 WISE program, she has had a summer internship with the U.S. Army Corps of Engineers. She plans to pursue graduate work in electrical engineering.

HKN Chapters in Action

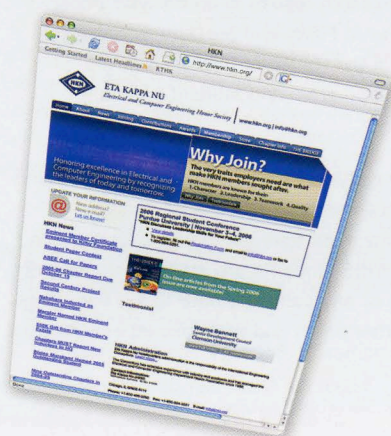


Second Century Project Results

Last year, to help plan for the next hundred years of HKN, students provided their feedback on the organization through the Second Century Project. The project consisted of two phases. The first phase was a collaborative session within the chapters, where members brainstormed answers to the following five questions:

1. What is the most important purpose of HKN?
2. What benefits should HKN offer student members?
3. How can HKN help student members better prepare for their careers?
4. How can your chapter better serve society, other ECE students, and their ECE departments?
5. What benefits should HKN provide to you after your graduation?

Members were able to reflect on their personal participation in the chapter, school, and organization as a whole as well as advise headquarters about what they felt were important benefits of membership. After collecting the responses, HKN staff devised a survey for individuals to rank the top 10 to 12 most common answers on a scale from 1 to 9. More than 200 individuals participated in Phase Two of the project. The staff analyzed the responses and came up with a list of action items consistent with the student's thoughtful suggestions.



Web Site

- List career opportunities, study-abroad opportunities, scholarships, graduate schools, and resume tips (Goal: February 2007)
- List contact information and activity suggestions for chapters (chapter reports will be linked to the directory pages)

Awards

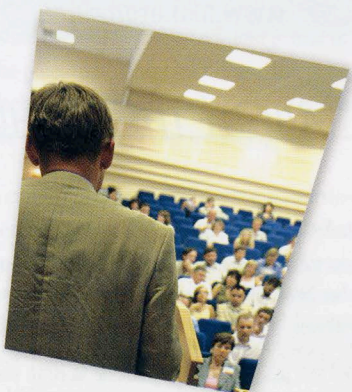
- Publicize nominations and award winners on-line, in THE BRIDGE, and in other appropriate venues depending on the award and the winner
- Invite students to awards ceremonies and allow them to interact on a one-on-one basis with distinguished alumni and professionals

Conferences

- Host regional conferences across the United States
- Develop leadership and other useful job skills for students entering the business world
- Invite distinguished alumni and industry professionals to lecture
- Allow networking opportunities among chapters

HKN Alumni

- Encourage the active participation in HKN of graduated members throughout their lifetimes
- Encourage the establishment of HKN alumni chapters
- Keep alumni up to date on industry and HKN news through e-mail, Web site updates, chapter news, and THE BRIDGE
- Invite alumni to speaking opportunities at chapter functions and regional conferences



HKN Chapters in Action



HKN Regional Student Conference

Beta Chapter, Purdue University, hosted a regional conference November 3–4, 2006, titled “HKN Discusses Leadership Skills for Your Future.” Student members listened to panels of distinguished alumni, cooperated in team projects, toured the Birck Nanotechnology Center, and shared stories of chapter activities. Due to the generous contributions of HKN alumni members, there was no registration fee for the conference, and a number of schools nationwide were represented. Chapters across the country are encouraged to host a student conference and can contact headquarters for information about how to organize it and get financial support.



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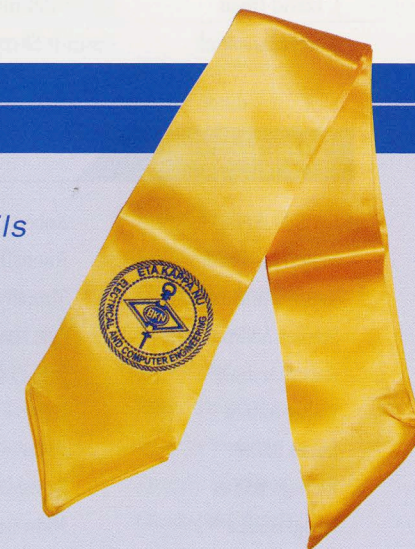
Various publications on topics such as telecommunications, satellite communications, VoIP, and wireless LANs are available to HKN members at an extremely reduced rate!

Jewelry

Visit the Web for a link to Burr Patterson, where you can order tie tacks, enameled crests, and key rings.

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Eta Kappa Nu thanks its many generous donors who have contributed to the 2005–2006 Annual Campaign. As HKN enters its second century of service, it is renewing its important service mission through many notable improvements in university-chapter relations, student member leadership development, broadened volunteer support, working relationships with ECE department chairs, and improved communications including an updated Web site, a newly formatted magazine, and e-mail communication with members.

\$50,000		\$10,000		* Eta Kappa Nu was fortunate to receive a \$50,000 gift from the estate of Ernest E. Althouse. Mr. and Mrs. Althouse's contribution to Eta Kappa Nu was inspired by their parents' commitment to education and the sacrifices they made for their children's college education.	
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