IEEE HIGH SCHOOL STUDENTS GET FIRED UP ON ROBOTICS P. 10

The Institute

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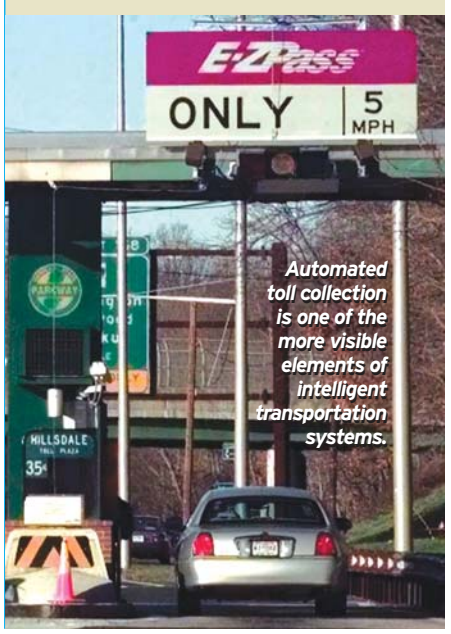
Getting Smart About Getting Around

BY CAROL GOODALE

LINES AT HIGHWAY tollbooths can be maddeningly long, but not for vehicles in the electronic toll-collection lanes. Most drivers zipping through these special lanes have no idea that the good time they're making is because of technical developments in the field of Intelligent Transportation Systems, or ITS for short. Consider these other ITS developments:

- In Japan, a video camera inside the front window of a Honda is part of the Lane-Keeping Assist System. By sensing lane markings ahead, the system knows if the car is straying from its lane. Then, by adjusting the power steering, the system can keep the car centered. Another Honda system maintains the optimal distance between it and the car ahead by regulating the vehicle's speed.
- In California, traffic management systems, using cameras and roadway sensors to collect real-time speed and traffic-density information, [Continued on page 14]



Automated toll collection is one of the more visible elements of intelligent transportation systems.

Making a Difference Section by Section

IEEE members work in their communities to educate, enrich, and encourage their neighbors

BY ERICA VONDERHEID

FOR SOME IN THE IEEE, membership has come to mean more than a vehicle for tending to their professional lives. These members also are finding it rewarding to devote time to improving the communities in which they live.

For example, members of Women in Engineering (WIE) affiliated with the IEEE Bombay Section in Mumbai, India, are reaching out to assist rural communities in their vicinity. Almost every month nine teams of four IEEE members and student members—including at least one female student and a professor from the Pune Institute of Engineering and Technology—travel up to 300 kilometers into the countryside to give lectures and demonstrations about the basics of engineering and science to youngsters in elementary schools and to teenagers in high schools and junior colleges.

"Our goal is to transfer our knowledge about computers, information technology, electronics, telecommunications, and instrumentation to students," says IEEE Senior Member Madhuri Joshi, chair of the Mumbai WIE group and a professor of electronics and telecommunications at the Pune institute.

These classes, demonstrations, and experiments—one project has students soldering components on a printed circuit board—go beyond engineering to encourage critical thinking skills and a love of learning. The Mumbai WIE group also brings in successful woman engineers to inspire girls to enter the field and scientists working in energy conservation to talk about how to use natural resources wisely. [Continued on page 12]

IEEE members from the Bombay Section visit with school girls to talk about how technical things, like this mobile phone, work.

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THE INSTITUTE ONLINE

Find information on these topics and more at www.ieee.org/theinstitute on 4 June.

Dean Kamen on Inventing

The prolific inventor Dean Kamen, who founded the FIRST Robotics Competition, talks with *The Institute* about what inspires him to invent, as well as about the importance mentors can play in encouraging young students to seek careers in science or technology.

PLUS

NEWS Four IEEE members receive the National Academy of Engineering's Draper Prize.

PRODUCTS & SERVICES IEEE journals and magazines pack more bang for the buck than their competition.

FEATURED CONFERENCE International Symposium on Electromagnetic Compatibility, 9–13 August, Santa Clara, Calif., USA.

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NEWS

FROM AROUND THE IEEE & THE WORLD

United Nations Honors Robinson

IEEE FELLOW CHARLES J. ROBINSON was inducted as an academician into the World Academy of Biomedical Technologies. He was honored in April at the First World Congress on Men's Health Medicine in Paris. The academy is part of the U.N. Educational, Scientific, and Cultural Organization. Robinson is chair of biomedical engineering and micromanufacturing at Louisiana Tech University's Center for Biomedical Engineering and Rehabilitation Science in Ruston, La., USA. He received the 2001 IEEE Richard M. Emberson Medal for contributions to the institute's technical objectives.

Wireless Expert Receives Leadership Award

LIFE FELLOW IRWIN M. JACOBS [right] received the Industry Leader Award from the IEEE Communications Society. The award was presented by John Chambers [left], founder and CEO of Cisco Systems, Inc., at the IEEE Wireless Communications and Networking Conference in March in Atlanta.

Jacobs, honored for his contributions to the development of wireless communications, is chairman and chief executive officer of QUALCOMM Inc., in San Diego. The company is the world leader in code-division multiple-access digital wireless technology.

Four Quarterlies Being Unveiled

THE IEEE IS LAUNCHING four new quarterly journals this year. *IEEE/ACM Transactions on Computational Biology and Bioinformatics* and *IEEE Transactions on Dependable and Secure Computing* print their first issues this month. *IEEE Transactions on Automation Science and Engineering* arrives in July. The first issue of *IEEE Geoscience and Remote Sensing Letters* was out in January; its third issue is due in July.

In the circuits area, the IEEE Circuits and Systems Society modified the names of two of its monthly publications to better reflect their editorial scope. The two journals are now *IEEE Transactions on Circuits and Systems Part I: Regular Papers* and *IEEE Transactions on Circuits and Systems Part II Express Briefs*.

Papers expected to be highly referenced by others will be published in *Part I: Regular Papers*. Shorter papers reporting on noteworthy results in circuits and systems will be published in *Part II: Express Briefs*.

To subscribe to any of these publications, click on http://shop.ieee.org/store/Overviews/periodicals.asp.

New Search Function for Xplore

IEEE XPLORE, the online document delivery system for the IEEE's publications, is adding a new search function. With it, a key-word search can be made of an entire article instead of only the article's abstract, as was the case before.

So far, only 10 percent of the documents in IEEE Xplore can be searched this way, but more will be available during the year.

Links to IEEE Computer Society articles were also added during the search upgrade. Subscribers can now link to papers referenced in more than 20 IEEE Computer Society publications. These references, traditionally placed at the end of a technical paper, are now part of the document's abstract at the beginning. If a referenced article is in IEEE Xplore, the user can link to the paper directly. For papers not published by the IEEE, the link is to the Ask*IEEE document delivery service or to the sites of other publishers, which should have the articles available for purchase.

Try out IEEE Xplore at http://ieeexplore.ieee.org.

—Compiled by Dixita Patel

MARKETPLACE OF IDEAS

Job Seekers

In today's engineering employment market, is it easier to find a job with a narrow skill set targeting a specific technology or with a general background covering a broad range of fields? Tell us about your experience.

RESPOND TO THIS QUESTION by e-mail or regular mail. Space may not permit publication of all responses, but we'll try to draw a representative sample. Your comments are subject to editing for brevity. Suggestions for questions are welcome. Your answers will appear in the September issue of *The Institute*.

E-MAIL: institute@ieee.org

MAIL: The Institute, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08855-1331 USA
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RESPONSES TO MAY'S QUESTION

A study reports that electrical engineering has one of the lowest percentages of female assistant professors at U.S. universities. Why are so few women on EE faculties?

To Be or Not To Be

The ratio of women to men in electrical and computer engineering jobs in academia is similar to that in industry. Both fields have problems attracting young women. Instead of emphasizing aspects that would appeal to women, high schools and colleges bombard females with these fields' unfavorable characteristics.

When I was in high school, the guidance counselor suggested that I would find engineering too difficult because it was male-dominated. He said I would be happier as a nurse. In college, a female professor told me that I did not have the mind-set to be an engineer because I was too creative. In class, some of the male students would not share group work projects. I was forceful enough to demand my fair share of work so I was never left behind. However, not all women are as extroverted—or pushy—as I am.

If more females in electrical and computer engineering encourage students, emphasize the value of teamwork, and allow for diverse learning styles, then a solution to the problem of too few female engineering professors may be found.

MIRIAM BECKER
Farmington Hills, Mich., USA

Recruiting Females

The electrical engineering field is actively recruiting females. Smart and well-educated female engineers are a scarce resource compared with male engineers. In an effort to maintain balance and diversity, corporate research and development organizations consider females prized targets for recruitment and retention.

To attract a highly qualified job candidate, the corporate world can offer higher salaries, better benefits, bonuses, and career advancement opportunities that academia cannot easily compete with.

DANIEL RABIDEAU
Acton, Mass., USA

Family vs. Career

As a former assistant professor of electrical engineering, I can testify that it was an easy choice for me to leave academia. When I graduated with my bachelor's degree, I worked in telecommunications engineering. I earned my master's degree in night school, which I finished after my first son was born. Having children to care for, I chose not to pursue a doctoral degree. Later, with my kids in preschool, I worked as a part-time assistant electrical engineering professor, but I found the lack of job security in academia uncomfortable. Once the kids were in school all day, I went back to engineering.

DOROTHY WRONA
West Springfield, Mass., USA

No Discrimination Here

That the percentage of females in engineering professorships is lower than the percentage of females in the overall population may not indicate discrimination. I suspect the disparity results because there are fewer women in engineering qualified to be professors. As I recall from my school days, 10 percent or less of the women became engineers. If discrimination is in question, I recommend conducting a study to compare the number of male and female candidates who are hired as professors with the number of men and women who applied for such positions.

CHARLES PENDLETON
Palmdale, Calif., USA

Role Models Wanted

Throughout elementary school and high school, engineering was never presented as a career choice for women. My eldest daughter majored in mechanical engineering and her sister majored in electrical engineering, but they never received any information on engineering as a career from their schools. They learned about engineering as a career choice through my position as former chair of the IEEE Southern New Jersey Section.

We will continue to have few women engineers in industry and academia until there are enough role models to encourage young girls to consider an engineering career.

DOROTHY BUCKANIN
Galloway, N.J., USA

Correction

Dale Callahan's name was misspelled in "Business 101 for Engineering Entrepreneurs" [March].

LETTERS

Land Mine Detection

It is wonderful that so many talented engineers are developing land mine detection equipment ["Saving Lives, One Land Mine at a Time," March, p. 1]. But I find it sad that another group of talented engineers is designing more lethal, harder-to-detect land mines and more high-tech paraphernalia for war. Money really shouldn't be the only reason to be an engineer. A conscience and respect for the sanctity of life also are worth considering.

ROB CURTIS
Wentworth Falls, Australia

There is no doubt that developing ground-penetrating radar systems to identify land mines is engaging work, but the mines still have to be removed. What happened to the "keep it simple, stupid" principle of designing such low-tech applications as using a concrete roller to locate the mines by rolling over and detonating them? Such rollers could be built in the field and attached to an ordinary truck. Everyday debris such as rocks, sticks, and trash could be recycled and incorporated into the concrete mix, because the mix wouldn't be used for construction. The US$33 billion estimated cost of clearing the world's mine fields could buy a lot of cement.

LLOYD ANDREW
Arnold, Md., USA

Membership Concerns

Last year two issues caused me to not renew my membership: IEEE–USA's campaign to lower the cap on H–1B visas and IEEE's acquiescence to U.S. sanctions affecting its international services. IEEE's actions and published articles over the past year on those two issues have damaged its image as an international and professional organization. But after reading the "President's Column" [March, p. 5], I was relieved to see that the IEEE at least acknowledges these problems and is dealing with them. Therefore I will reinstate my membership in hopes that the IEEE will become more sensitive to its international members.

Like thousands of other scientists and engineers, I came to the United States through the H–1B process. There is a misconception that H–1B immigrants are competing with U.S. engineers for jobs. In reality, H–1B immigrants are a highly select group of skilled workers who bring unique talent to the United States. An arduous selection process ensures H–1B applicants do not displace any U.S. workers. In short, the high level of intellect imported by H1-B visas is what makes the United States a leader in today's technological world.

I strongly recommend the bylaws be amended so that all IEEE–USA members have the right to vote on matters they're concerned about. At the very least, members should be informed of the issues so they can voice their opinions well before IEEE–USA takes any action.

RAMI A. KISHEK
Silver Spring, Md., USA

Getting Down to Business

I enjoyed the article, "Business 101 for Engineering Entrepreneurs" [March, p. 1]. Its global perspective was refreshing. More than most, entrepreneurs need to think outside the box, and "thinking outside the borders" is one way of doing that. I live near the U.S.–Mexican border, so I was especially intrigued by entrepreneur Roberto Poujol's commitment to creating a high-tech success [in telecommunication services] in Mexico.

ROBIN HEWITT
San Diego, Calif., USA

TELL US WHAT YOU THINK

We welcome letters from readers expressing opinions on matters of interest to the IEEE members and to the technical community at large. Please include your city, state, or province and country.

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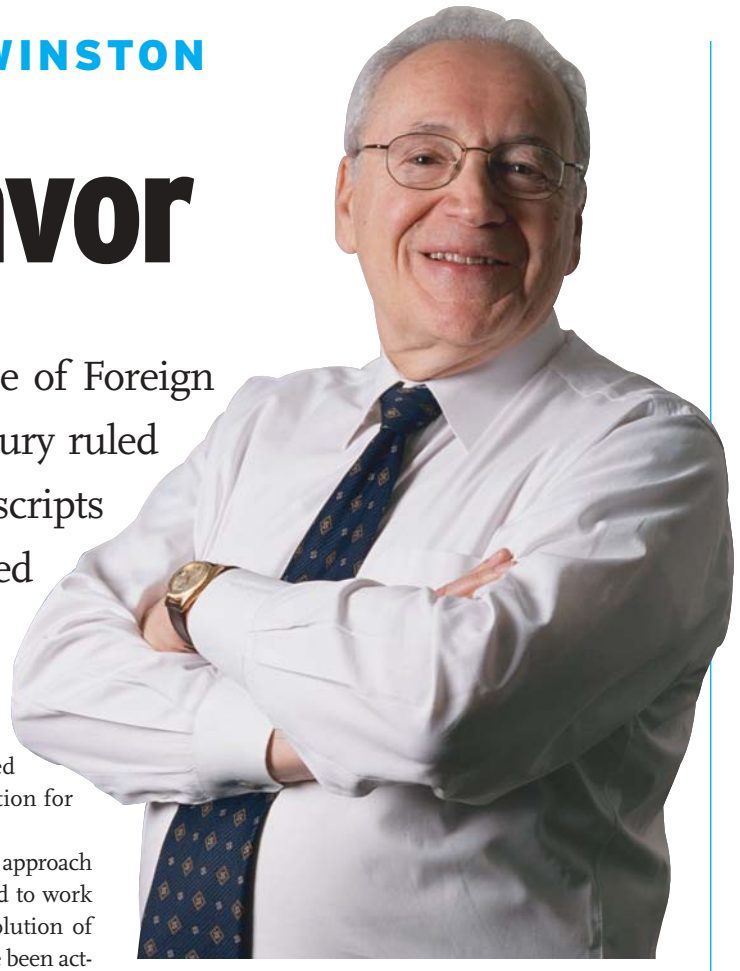
A Ruling in Our Favor



In early April, the IEEE received very good news. The Office of Foreign Assets Control (OFAC) at the U.S. Department of the Treasury ruled that the peer review, editing, and publication of manuscripts submitted to the IEEE by authors living in U.S.-embargoed countries, including Cuba, Iran, Libya, and Sudan, can be conducted free of U.S. government restrictions.

The ruling represents major progress in the IEEE's quest to overcome the difficulties caused by the U.S. government's trade embargoes on sanctioned countries, which we have been struggling with for nearly three years. It clarifies uncertainties raised by an earlier ruling, received in September 2003, that exempted peer-review activities from OFAC regulations but prohibited the IEEE from editing without a license. The 2 April decision frees us to conduct our entire peer-review process, including style editing and copy-editing, without being subject to OFAC regulation or licensing, regardless of where an author resides. This will likewise benefit other scholarly publishers who have similar processes.

This important ruling is the direct result of months of intensive efforts to help OFAC officials understand the intricacies of IEEE peer review and editing. Additional impetus for this desired outcome came from the input of participants at an IEEE-convened summit of scholarly publishers in February, which brought the publishing industry and OFAC face to face for the first time. We believe IEEE also benefited from ongoing activities of other publishing organizations and individuals in the U.S. government vis-à-vis the OFAC regulations. Through it all, the IEEE Board of Directors has remained firm in its belief in the unfettered exchange of scientific and technical information for educational and research purposes.

In the ruling, OFAC commended the IEEE's approach "to comply with federal law in this matter, and to work with [OFAC] in good faith to arrive at a resolution of these issues." This makes it clear we would have been acting against the law to do otherwise. I am personally pleased with this acknowledgement of our efforts since our global organization has always reflected the highest legal and ethical standards as we abide by the laws of all nations where we operate.

This positive ruling is significant, but it does not put OFAC concerns entirely behind us. OFAC regulations continue to challenge our ability to provide many services to members in embargoed countries. We are reviewing these membership issues and working diligently to find solutions that benefit all members.

This situation has been very difficult for our organization and our members worldwide, and it is of great concern to all the engineering, science, and publishing communities. Since I became 2004 IEEE president, I have heard from and communicated with many members on this subject.

I want to thank you, our members, for openly voicing your opinions about OFAC's restrictions on our publishing operations and our membership benefits. Your comments enable us to form a collective voice—and I assure you, it has been heard. I encourage you to continue to express your views on this matter.

The many messages I have received confirm my belief in the importance of communicating with you about this issue. We remain committed to keeping you informed. We will continue to run articles on the subject in *IEEE Spectrum* and *The Institute*, as appropriate. Additionally, we maintain a page at http://www.ieee.org/ofac to provide the latest, most accurate information in an open manner.

We will continue to do what is necessary to resolve the outstanding OFAC issues. I encourage your support, and I invite your comments at president@ieee.org.

The Institute

Editorial offices:
IEEE Operations Center,
445 Hoes Lane, Piscataway, NJ 08855-1331 USA
Telephone: +1 732 562 6825
Fax: +1 732 235 1626 **E-mail:** institute@ieee.org
Web: http://www.ieee.org/theinstitute

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Assistant Editor: Erica Vonderheid
Editorial Consultant:
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Contact Points:
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The Many Faces of Mentoring

Everyone benefits when engineers teach and counsel their younger (and older) colleagues

BY ERICA VONDERHEID

MENTORING—THE EXPERIENCED leading the inexperienced—has changed a lot since many IEEE members began their careers.

"We used to give young engineers a stack of engineering books to read or have some old guy tell them war stories about what it was like when he was just starting out," says IEEE Member Bill Gjertson, who has been a mentor for more than 10 years at Boeing Co., in Seattle, Wash., USA.

Today, according to Gjertson and others, mentoring is more than just job training. It involves counseling, guiding, and teaching young professionals—and students, as well—how to become successful engineers.

"Mentoring is helping young people understand the realities of life and what it takes to advance their careers," says Member Rajagopalan Kannan, who goes by the title of "additional" general manager of research and development at Bharat Heavy Electricals Ltd., in Hyderabad, India. He's been advising younger colleagues for several years.

Mentoring can take many forms, from a casual conversation about a project during a coffee break to formal programs that match mentors with protégés. Engineers today can coach protégés who aren't at the same company or even in the same city. Through e-mail, people who might otherwise not have met can be brought together.

MentorNet, a nonprofit group, has set up a free, online community that relies on a series of questionnaires to pair any engineer or scientist who volunteers to be a mentor with undergraduate- through doctoral-level college students. Each pair then chooses how to communicate, whether by telephone, e-mail, or face to face.

Carol Muller, MentorNet's cofounder, points out that for any type of mentoring relationship to succeed, several essential elements must be part of the process. First, mentors and protégés need to set ground rules for the relationship.

"It's important that the two people are clear about what they're going to do and the time they're willing to commit," Muller says. "They should also agree on how often they'll meet, who should contact whom, and how long the relationship will last.

"A mentoring relationship is like any other learning experience," Muller continues. "It's only going to be satisfying to those involved if they're headed in the same direction and if they've articulated what they expect to gain."

Another essential element is that a mentor should offer constructive criticism of his or her protégé's work. "Ideally, you want a mentor who will tell you what your weaknesses—as well as your strengths—are," Muller says.

And mentoring is not necessarily always a "one-way street," notes Gjertson.

"When I mentor young engineers, I often learn about using new equipment, and especially computer software," he says. "And because I get another set of eyes to look at a problem, I may see things differently and expand my understanding of a technical principle."

Indeed, because technology changes so quickly, some organizations today are even turning to reverse mentoring. Here, a younger staff member will school an older colleague or manager about new technologies and trends.

Sameer Kalra, a telecommunications engineer at AT&T Corp. in Middletown, N.J., USA, and an IEEE member, says he has coached his more established colleagues on new technologies his company has adopted.

"Older engineers begin to respect you if you're well versed in a technology," Kalra says. As a result, these colleagues will be friendlier and try to help you become a better engineer, he adds.

"Reverse-mentoring improves productivity because [the engineer] experiences less stress from learning a new technology and can focus on the task at hand," Kalra says. Besides increased productivity, Muller says the company also benefits because mentoring is a good way for managers to identify emerging talent.

MENTORING JUNIORS Some IEEE members choose to mentor high school students interested in a technical profession.

Dawn Nedohin-Macek, a computer engineer and member in Winnipeg, Man., Canada, regularly exchanges e-mail with a teenage girl interested in science and engineering who lives in Edmonton, Alta., Canada—more than 1300 kilometers away. Nedohin-Macek says she corrected some misperceptions the student had about engineering—that engineering is only "math and numbers"—and hopes the teenager will choose the field as a career. They met through an engineering mentoring program set up at the University of Alberta, also in Edmonton.

Nedohin-Macek believes mentoring by e-mail can work well, especially for teenagers, because it is a medium they're familiar with. The mentor seems less imposing. "It can be pretty scary to meet with somebody from a university, or somebody who reminds you of your mom," she says.

Life Senior Member Walter Myers, a retired utility engineer, recalls that he wasn't prepared for how strong the high school kids were technically when he first became a mentor.

"I would give a student something to do for one of her courses, she would finish it, and I would have to start all over again to try to fill the rest of the time we were to be together," Myers says. He then started keeping a file of problems he came across in his work for the Bonneville Power Administration in Portland, Ore., USA. These were problems that needed to be solved but that Myers had no time for.

Mentoring high school students allows members like Myers to help teenagers interested in science or engineering focus the courses they take at their schools. They also get help with the coursework and some knowledge of what they might find in a technical profession. This may drive students either to become more interested in science or to discover that science or engineering is not the right fit, Myers points out. If they realize that technology is not for them, that's of value too.

Myers now volunteers for the Apprenticeships in Science and Engineering (ASE) program at Portland State University, in Oregon, USA, a program supported by the IEEE Foundation and the IEEE's Portland (Ore.) Section. The program provides high school students with more than one-on-one mentoring, putting them into eight-week apprenticeships with employers in the Portland area, such as Intel, Hewlett-Packard, and Xerox. Myers also successfully petitioned the Oregon engineering licensing board to have mentoring activities count towards a professional engineer license. [For another high school program involving mentors, see "Fired Up by Robots," p. 10.]

Many who have participated as mentors agree that their work benefits more than just the protégé, who may get sage advice and a sympathetic ear. Mentors may gain insight about themselves as well as about how to work better in their own jobs.

"When you're a mentor, you learn about psychology, aspirations, different people's attitudes toward engineering, and their approach to the problems they face," says Bharat's Kannan. All of these have analogies in the mentor's own professional, or even personal, life. Advising a younger colleague or student, notes MentorNet's Muller, may bring mentors to reflect on their own career paths and recall what excited them about engineering in the first place.

Hans Stork Has Semiconductors On His Mind

Texas Instruments' CTO Hans Stork

BY PEG GALLOS

HANS STORK, recently promoted to the position of chief technology officer of Texas Instruments Inc., in Dallas, USA, is working with a technology whose potential is always on his mind: semiconductors. "I am fascinated with the technology it takes to produce a chip today, and with every aspect of the process," he says. When asked about the future of the tiny technology, Stork describes how "a waterfall" of ideas runs through his mind.

Conveying his own enthusiasm is one important element of his new role at Texas Instruments, but far from the only one. In his new position, Stork is responsible for Texas Instruments' long-term R&D strategy and for building the company's reputation as a top developer of silicon technology. "Communicating an enticing message of what our technology holds in store is important, but balancing the business side is just as crucial," he says. His goal is to see TI develop products by fitting the skills of its employees with the company's resources. "That is the most important challenge," he adds.

Before joining TI, Stork worked in the research labs of high-tech heavyweights IBM Corp. and Hewlett-Packard Co. He spent 12 years with IBM working on silicon programs and high-end computing projects before joining H-P. There he spent five years on ultra-large-scale integrated circuit programs and then went on to manage large-scale computer projects.

"You know, Hans, when you talk about semiconductors, your whole face lights up," Stork recalls an H-P colleague telling him one day. He remembered that remark in 2001 when Texas Instruments, widely recognized as a leader in semiconductors, offered him the chance to return to work on the technology that had so wholly captured his interest. He was TI's senior vice president of silicon technology development until his recent promotion to the CTO role.

FORMATIVE YEARS "World-class quality" in every aspect of one's work is essential for young engineers in today's super-competitive global marketplace, according to Stork. This is a lesson he learned not only from his peers at the IEEE, he says, but also while growing up in Soest, the Netherlands, a town 45 kilometers southeast of Amsterdam. Stork grew up in the aftermath of World War II, a time of intense rebuilding in his native country. His father's machine shop manufactured such products as portable stairways used for boarding airplanes from the tarmac. Among his father's customers was the Dutch airline KLM. "I saw my father manage his own destiny and worry about his company," Stork recalls. The dedication Stork saw in his father nurtured in him a strong work ethic, he says, the downside of which can be a tendency to overwork.

"My brother and sister have the same problem as I do," he jokes.

As a young man, Stork considered studying mechanical engineering but decided it was too hands-on. He thought about a career in physics, but that was too theoretical. Lasers moved him toward electrical engineering because he thought the technology was "cool."

Stork earned his bachelor's degree in electrical engineering in 1978 from Delft University of Technology in the Netherlands. In 1982, he received his Ph.D. from Stanford University in California, USA. Later that year, he joined IBM's T.J. Watson Research Center in Yorktown Heights, N.Y., USA, where he investigated advanced bipolar technology and circuits and, later, silicon germanium (SiGe) technology.

In 1987, he took a position with IBM's Exploratory Device and Technology area, a group he went on to lead from 1992 to 1994. Stork was also the manager of the Bipolar Devices group, leading a task force on high-end computing. Then in 1994, he joined the Hewlett-Packard Ultra-Large-Scale Integration Research Laboratory in Palo Alto, Calif., USA, where he was director from 1995 to 1999. Stork later managed the lab's Computer Systems and Technology Laboratory, focusing on large-scale distributed systems and novel architectures and technologies.

Stork became an IEEE fellow in 1994 for his contributions to SiGe devices and technology. He was also very active in the IEEE as a member of its Electron Devices Society, for which he has chaired many committees. Stork has also written several articles for various IEEE journals.

Stork respects the technological rigor the IEEE expects from its members. He also recognizes the importance of the networking opportunities the organization offers. When he first joined, Stork attended IEEE's conferences and read its journals, he says, and he drew from them a high standard for his own work. When his professional tasks became more complex, he found the conversations with his IEEE contacts becoming more valuable. In the past 10 years in particular, networking at various IEEE events has benefited Stork considerably, he says, as he made his rise up the managerial ranks.

For all of his technological background, Stork still appreciates the classical education he received in his country's "gymnasium" system, the equivalent of high school in the United States. That educational system provided him with an excellent foundation in foreign languages, various sciences, history, politics, and geography, Stork says, all of which helped him make informed choices later on.

Even though he has lived in the United States for the past 27 years, Stork still respects the wisdom of European society.

"We forget in the U.S. there are other ways to look at life. Europe is maturer in some ways, partially because of its diversity. We say 'Europe' when in fact it is France, Germany, Belgium, and so forth," Stork says.

Still, Stork appreciates America's vitality.

"European culture is less daring," he says. "American culture says 'tomorrow will always be better,' and failure is not a stigma. One has the ability to be creative. A lot of entrepreneurship emerges from the climate this country encourages."

FIRST Competition Gives Students A Taste of the Engineering World

FIRED UP BY ROBOTS

BY KATHY KOWALENKO

Thousands of screaming fans were in the Georgia Dome in Atlanta in mid-April, and they weren't there for an off-season football game. Rather, they were cheering their favorite robots as they raced through its paces in the finals of the 2004 FIRST Robotics Competition Championship.

The competition for high school students drew nearly 300 teams and 7000 contestants to Atlanta from around the United States and Canada. Finalists for the two-day event had been chosen from more than 900 teams from Brazil, Canada, Mexico, the United Kingdom, and the United States. Each team had matched wits earlier in 26 regional contests around the United States.

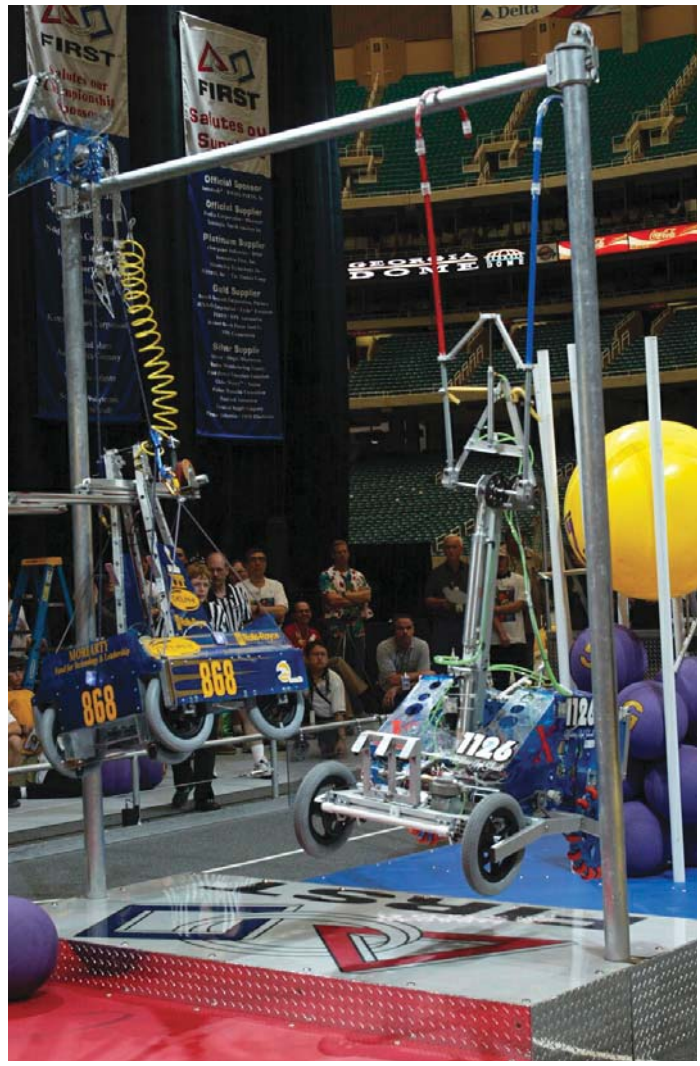
FIRST (For Inspiration and Recognition of Science and Technology) is supported by a network of national corporations, including CDW, Coca-Cola, and Dassault Falcon, as well as educational institutions and professional engineering associations, such as the IEEE. In fact, hundreds of IEEE members volunteer to mentor the students and help them build their programmable, remotely controlled robots. Volunteers include employees of sponsoring organizations, parents with children on the teams, and college students.

Now in its 13th year, the FIRST competition is the brainchild of Dean Kamen, president of DEKA Research and Development Corp., Manchester, N.H., USA. A prolific inventor, Kamen is best known for the Segway Human Transporter, a two-wheeled rolling platform maneuvered by a standing rider. Kamen created FIRST as a way to spark the interest of young people in science and technology.

"We work hard to make FIRST a microcosm of the real world of product development," Kamen told *The Institute*. "The teams have resource constraints, time constraints, and budget constraints. They've got to organize themselves to build the entire system and ship it out, and it's got to work."

IEEE member Carl Hansen, a mentor for the Red Devils team from Rancocas Valley Regional High School, Mount Holly, N.J., USA, compares FIRST to a full-scale engineering project. He's been working with FIRST teams since 1994.

"In addition to designing and building a robot, the students learn firsthand about project management, marketing, graphics design, computer-aided design, you name it," says Hansen. He's a senior member of the engineering staff at Lockheed Martin Maritime Systems and Sensors, which is also in Mount Holly and sponsors the Red Devils.



For some students, it's the first time they've ever met an engineer.

"No one in the family is an engineer, so my son would have had no opportunity to work with engineers otherwise," says Vickie Cawthon of Oconee, S.C., USA. Her son, Daniel, was on the Metal-in-Motion team, which is sponsored by the IEEE Piedmont Section in Greenville, S.C. "FIRST was a great learning experience for him because he met terrific engineers in a lot of different fields."

LOTS TO DO Teams are composed of 15 to 25 students, along with their adult mentors, who must have a technical background. The teams begin forming in the fall, and things really heat up in January, when a kit of standard parts for the robots arrives. Included are a microprocessor and a remote control system, as well as wheels, a gearbox, 12-volt battery, and cooling fans. The structure of the robot depends on the teams' ingenuity.

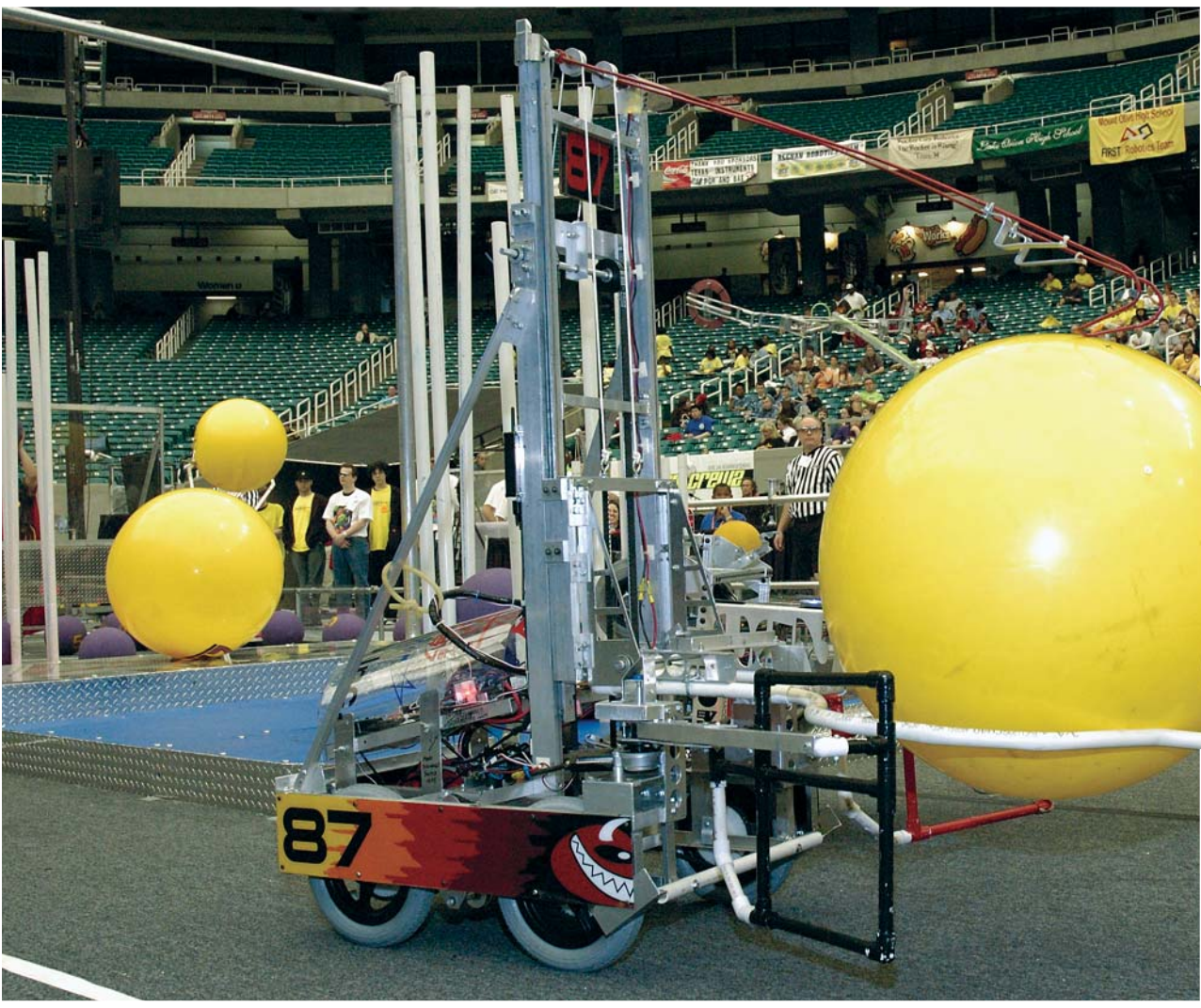
But while waiting for the kits, the students must get busy raising money. The entry price is US$5000 for the 300-part kit and participation in one regional competition; each regional after the first—teams can enter more than one—is another $4000. Other expenses include team uniforms, tools, and travel expenses. Add up all the costs and it becomes obvious that more than engineering savvy is needed to produce a winning entry.

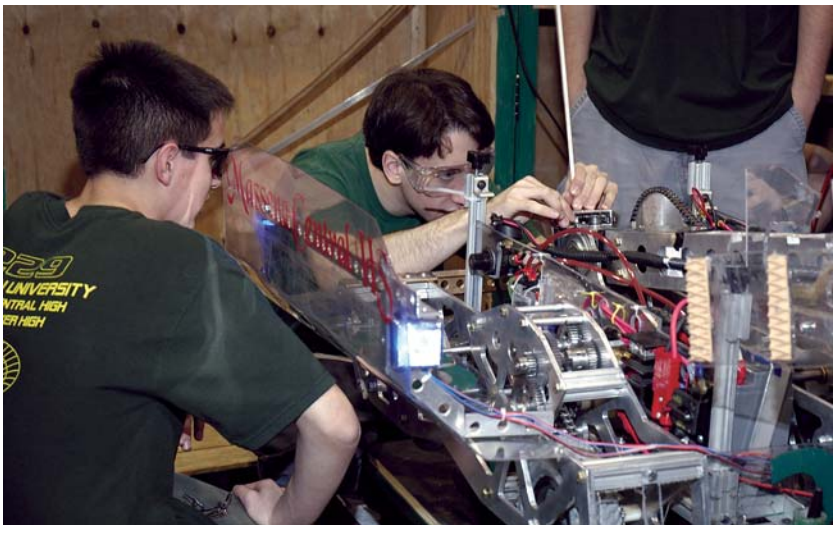
Students must hone their marketing skills so they can attract sponsors to donate money, and they must hold successful fund-raising events. Each team must also design a Web site that markets the team and its robot, and it doesn't hurt to jazz the site up with video animation. Clearly, there's a job for everyone.

"Every kid can participate in FIRST," Kamen told *The Institute*, "from the ones who want to turn wrenches and write code, to the ones who decorate

their machines, to those who raise funds to get to the national event."

Each team has six weeks to build its robot for the regionals that begin in March. Each year, the parameters change. For the Atlanta championship, called "FIRST Frenzy, Raising the Bar," the machines could weigh no more than 59 kilograms, nor measure more than 75 by 90 by 150 centimeters.





GAME DAY. With his game face ready, a Gearheads team member from Somerville High School, Somerville, N.J., USA [far left], is ready to take on the competition.

Trying to score a few extra points by using their "arms" to hang from a bar [middle left] are robots from Webster High School, Webster, N.Y., USA, (1126), and Carmel High School, Carmel, Ind. USA, (868).

During one of its matches, the Red Devils robot, under radio control [above], lifts a large ball that it then must place atop a bin holding smaller balls.

Budding engineers from the Division by Zero team from Clarkson University and the Massana and Salmon River high schools in Potsdam, N.Y. USA, [left], tune their robot before putting it through its paces.

A robot also needed a scoop to pick up balls and some sort of arm that can reach up to grasp a bar at the center of the playing field. And there were tasks to perform during a two-minute "match":

- Travel over a preprogrammed path for 15 seconds without any input from the "driver," the team member on the remote control.
- Release 18 30-cm-diameter balls from an overhead bin; scoop them up one at a time from where they'd come to rest; and roll over and hand the ball to a designated student, who must then toss it into one of several bins set up on the field.
- Pick up and place a 75-cm ball, set out on the field before the match, on top of any smaller ball already in a bin.
- For extra credit, hang from a 3-meter-high bar placed at midfield without touching the ground.

FACING OFF A match begins when a pair of teams, in a partnership called an alliance, faces off against another pair of teams. (Judges choose the alliances at random shortly before each match.) The performance of the robot as well as how well teams get along is taken into account in these alliances.

Judges—from engineering-related organizations such as Boeing, General Electric, and Northrup Grumman—award points every step of the way. (*IEEE Spectrum* had a judge at one of the regional competitions.) Which team wins depends only partly on how each robot performs. Success also depends on the team members' people skills, which are more important than who has the best robot.

Judges watch for such things as how the two teams work at developing a game plan for the match, and how well they generally get along by, for example, lending their tools or cooperating to replace faulty parts. Such interplay is important in helping kids learn to work well with people they've just met, notes Trevor Housten, a member of the Gearheads team from Somerville High School, Somerville, N.J., USA.

"You learn to quickly voice your opinions, hear other people's opinions, and come to a compromise," Trevor explains. "You don't have time to argue. I've been the driver of our robot for three years, and I've never had a conflict with another team."

The pairs of alliance robots face each other from along the short ends of a 225-by-445-meter field. The robots' drivers and teammates are along the sidelines. Parents, friends, siblings, chaperones, mentors, and invited guests do the cheering from the stands. A series of elimination rounds reduced the number of finalists to 24 teams. The top eight of these teams get to choose their alliance partners. But at this stage, an alliance is made up of three teams, in case a robot malfunctions. An alliance captain is chosen, and the captain selects which two of the three robots will compete.

This year's winning alliance consisted of the Martians from Goodrich High School in Goodrich, Mich., USA; Robodogs from Southeast Raleigh High School in Raleigh, N.C., USA; and B.E.A.S.T. from Clark, Gavit, Hammond, and Morton High Schools in Hammond, Ind., USA.

But the competition's most prestigious award, the FIRST Chairman's Award, doesn't go to the winning alliance. Instead the award recognizes sportsmanship, team spirit, and how the students got along with each other and their mentors and sponsors. This year the award went to the Cheesy Poofs team from Bellarmine College Preparatory school in San Jose, Calif., USA.

MULTIPLE BENEFITS Twenty-four other awards also were given in Atlanta for such qualitative accomplishments as entrepreneurship, creativity, innovative research, and inspiration. This year, about $4.5 million is also available to FIRST participants for merit scholarships at 40 universities and colleges. In addition, about half the corporate sponsors usually hire students for summer internships, either while they're still in high school or once they reach college.

And there are other benefits for the competitors. "There are a lot of kids who normally would not have come out of their shell if it wasn't for FIRST," says IEEE Member Tom Housten, the father of Trevor. "These kids are quiet and shy because they are more into the technical side of things."

The senior Housten has been helping the Gearheads team since 2000 when an older son joined the school's FIRST team.

Mentors benefit, too. For example, IEEE Student Member Thomas Horan mentored a team from an inner city high school and was glad to be "involved with students who didn't have as many opportunities as I had."

A senior at City College of New York studying power engineering, Horan has been a mentor since 2001, this time for the Rice High School team in the Harlem section of New York City. Working with their mentors "gives students a positive role model," says Horan. "And they learn a lot of hands-on skills that they can find very valuable later in life." ●

TO LEARN HOW to become a FIRST mentor, visit http://www.usfirst.org. Read an interview with Dean Kamen in *The Institute*'s June online edition.

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Senior Member Madhuri Joshi organizes groups of college students and professors from the Pune Institute of Engineering and Technology to travel to rural schools in the hope of interesting students in technology with projects like soldering parts to circuit boards.

Joshi reports that the WIE group is also considering developing a mobile library, or bookmobile, allowing students from ages 13 to 18 to borrow books for a month. The goal, she says, is to motivate students to read rather than watch television or surf the Internet.

WHATEVER NEEDS FIXING In Panama, IEEE members have been taking on the job of fixing technical problems in rural communities. In 1999, Jorge Him, the Panama Section chair at that time, started a program called "IEEE in the Community" where members travel to the countryside to find what they could do to help fix any technical problem that may arise. Often there is a malfunction in an electrical distribution system that the local utility cannot or will not fix. So IEEE members make the repairs and then teach the local people how to maintain their system. Sometimes communities request training for librarians, schoolteachers, church leaders, and even government workers in computer software and the Internet, says Senior Member Tania Quiel, the Panama Section chair.

The section set up a committee that evaluates project proposals from the villages, develops a budget, and recruits IEEE members to travel to the town—often a two- to three-hour drive from Panama City—on weekends to do the work. Frequently, members ask local companies to donate equipment.

In the southeastern United States, volunteers at the East Tennessee Section saw how their electronics expertise could save lives. After a series of fatal tornadoes and a hazardous waste spill in their area, IEEE members worked together with an amateur radio, or ham radio, organization to install a two-way radio in the American Red Cross building in Knoxville, Tenn., USA.

The section worked with the Amateur Radio Emergency Service (ARES)—a U.S. organization that marshalls amateur radio stations to help police and other first responders communicate in emergencies.

"In the event of a natural disaster like a tornado or a flood that could knock out power or telephone systems, ham radios can provide reliable communication," notes Member David Bower, an ARES volunteer from the East Tennessee Section.

Classes, Demonstrations, and Experiments Are Meant to Encourage CRITICAL THINKING and a Love of Learning

When a tornado approaches Knoxville, ARES notifies amateur radio operators throughout the region—some are IEEE members—with ham radios in their homes or cars. Amateur radio operators at the Red Cross coordinate the communication, and can confer with other agencies such as emergency services to relay information about the tornado's path and coordinate rescue efforts. Repeater stations in mountains surrounding Knoxville expand the network's reach to a radius of 145 kilometers. And during a state-wide disaster, repeaters elsewhere in the state can be linked together for communication anywhere in Tennessee.

ARES operators are trained to identify weather conditions that signal an approaching storm; how to respond to man-made disasters such as terrorism or hazardous waste spills; and the kind of information that should not be reported over the air such as victims' names.

"This project was something the section could do for the community," Bower says. "The Red Cross did not have funds for the station nor the expertise to install and operate the radio network."

A TASTE OF ENGINEERING In Ventura County, Calif., USA—just north of Los Angeles—IEEE members are introducing local teenagers to electrical engineering through a robotics Micro Mouse competition. It's cosponsored by the IEEE Buenaventura Section and the Greater Thousand Oaks Telecommunications Center, a technology facility available for community use.

The idea is for high schoolers to build a small mouse-like robot that must maneuver independently through a maze—the way a mouse would navigate a labyrinth looking for a piece of cheese. The fastest Micro Mouse to complete the task wins. IEEE members developed a kit of parts that helps the students build their mouse; they are also available to answer questions and help with technical problems. The members also asked local businesses to help fund the competition.

"The Micro Mouse competition is considered a difficult engineering design contest because it encompasses all the different skills, such as programming, design, and assembly, necessary to be an electrical engineer," says Senior Member John Wright, the chair of the Buenaventura Section. "I've met college professors who said they wouldn't do a Micro Mouse competition on campus because it's too hard."

To simplify things, the kits for the younger students have more built-in features than those for college students. And the robots come programmed with enough software so they run, but just barely. Teams with more initiative and talent can program additional functions into the robot, making it faster, more maneuverable, and more likely to win the timed race.

The Ventura County Micro Mouse teams have another barrier to overcome—distance. Each team has four members. Two are in California and two from a secondary school in the United Kingdom. The UK team members work on the robot's hardware while the U.S. students take care of software. A company based in the UK with an office in Ventura County arranged to broadcast the finals of the Micro Mouse competition over the Web.

INVOLVED RETIREES Members have found still other ways to encourage the next generation of engineers. For example, David Weiss, a retired IEEE life member in Silver Spring, Md., USA, is reaching out to younger students with Retirees Enhancing Science Education Through Experiments and Demonstrations or RESEED, a program out of Northeastern University in Boston. RESEED prepares engineers, scientists, and others with a science background to help upper elementary and middle school science educators with teaching the physical sciences.

"It seemed to me that enrollment of American students in science and engineering was declining, and I thought middle school [ages 12 to 14] was the ideal time to get these students interested in science," Weiss says.

Weiss read about RESEED in an IEEE publication and asked fellow retirees in the Washington, D.C., Section to get involved. Now Weiss spends his time helping teachers in the Montgomery Village Middle School in Montgomery Village, Md., to break down scientific and engineering concepts into manageable lessons. RESEED also encourages classroom experiments and demonstrations such as one that Weiss did to illustrate the importance of standardization.

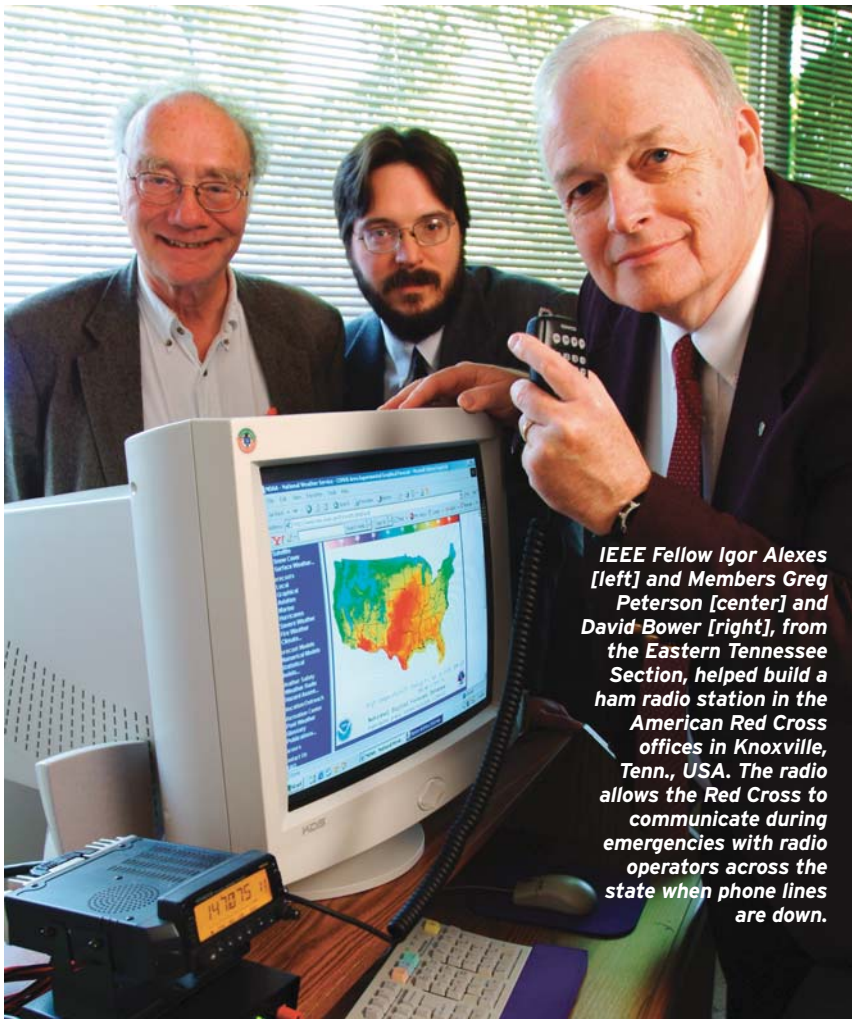
"I gave the students strips of colored paper of different lengths, anywhere from 20 to 25 centimeters long," Weiss explains. "They used these strips as rulers to measure the lab tables in their classroom. All the students came up with different answers to how long the tables were."

The teacher then asked the students to explain why they got so many different results, and it was then that the students realized that the rulers were of different lengths. "In this way, the need for standards—certainly for their rulers—was established in the minds of the students," says Weiss.

GIVING BACK Thanks to the efforts of IEEE members, communities may gain a more reliable source of electricity, a new emergency communications system, or better educated citizens. And the members who volunteer can count on the warm sense of having given something back to society. Often this is more than enough to keep them volunteering their help.

Bower, of the Eastern Tennessee Section, says his group started the amateur radio project because, "with the potential for disasters, this was a viable way to do something at a very low cost to the section that would be beneficial for the community."

And Joshi reports that for the Mumbai WIE members it was important to reach out to young girls to try to increase their numbers in engineering schools and to prepare them for a rigorous academic program. The most important element was to see young women they had visited enroll to study engineering at the college level.



IEEE Fellow Igor Alexes [left] and Members Greg Peterson [center] and David Bower [right], from the Eastern Tennessee Section, helped build a ham radio station in the American Red Cross offices in Knoxville, Tenn., USA. The radio allows the Red Cross to communicate during emergencies with radio operators across the state when phone lines are down.

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Electronic billboard on the Pennsylvania Turnpike, USA, warns drivers of traffic problems ahead. The billboard is part of a computerized information network being installed on the highway that will include cameras, weather stations, and emergency warning systems.

help avert traffic jams by advising drivers of alternate routes.

- In Seattle, a prediction of bus departure times for hundreds of locations is available on the Web and via mobile phones at MyBus.org.
- The Route 407 Electronic Toll Road in Toronto, Canada, has no tollbooths, saving millions in construction costs. Overhead sensors log vehicles at entry and exit points by querying onboard transponders. The toll is calculated and charged to the transponder's account.
- On Route I-75 between Toronto and Miami, Fla., USA, weight and cargo credentials of commercial vehicles are checked without slowing down; vehicles need not stop at weigh stations.

What winds up being installed in any place depends, of course, on costs and on the needs of a given locality. But these examples reveal the broad scope of ITS, in which the IEEE, its member societies, and individual members play important roles. ITS covers a broad set of disciplines, including information processing, communications, control, and computer science—all in the service of helping vehicles travel safely and with as little worry as possible for the driver and passengers. Applications range from simple to complex, and ITS participants include many different groups: government agencies and private companies, as well as academic and research institutes and professional associations. Actually, "intelligent" may be a misnomer. The word does not refer to cars that drive themselves or to other such clever things (though in the future, it might). Some ITS applications appear to be quite simple, such as the rewritable signs over a highway that warn of the traffic situation ahead, or digital clocks in a bus shelter displaying the time the next bus will arrive.

More complex are information systems that a driver can access to find road and traffic information over a wide geographic area. And there are incident management systems that monitor roads for accidents so that emergency vehicles can be dispatched quickly if an accident is detected.

As ITS has developed over the past two decades, the IEEE has provided a technological umbrella for the field. For example, the IEEE Intelligent Transportation Systems Council (ITSC), formed in 1991, provides a single forum for ITS–related

research performed by members in the 17 IEEE societies that belong.

The council cosponsors two technical conferences annually where people in the field can meet and mingle—the Intelligent Vehicle Symposium taking place this month in Parma, Italy, from 14–17 June and the ITSC conference in Washington, D.C., from 3–6 October.

The ITSC also publishes a newsletter and the journal, *IEEE Transactions on Intelligent Transportation Systems*, and it has established a coordinating committee.

INTERDISCIPLINARY BENEFITS ITSC offers a useful technical forum for interdisciplinary research, notes IEEE Member Alberto Broggi. He's the editor of *IEEE Transactions on ITS,* chair of the 2004 Intelligent Vehicle Symposium coming up in Parma, and a professor in the department of information engineering at the University of Parma. Broggi praises the IEEE for providing a "single, technical umbrella" to unify many different, previously scattered journals and meetings, as well as efforts in related fields.

Broggi's own work focuses on in-vehicle applications. "Basically, a car is no longer considered to be an engine with four wheels, but a bunch of electronics with an engine in between," he says. Such a definition points to the creativity with which ITS views vehicles and services. Broggi is exploring a current hot topic: the automatic detection of bicycles and pedestrians in the road ahead of a moving car.

"It is a complex problem," Broggi says. "Detecting cars is much easier since there you can work with a quite general model. But pedestrians and bicycles offer many different postures, colors, and textures."

Another project collects data on the eye movements and steering behavior of sleep-deprived subjects. This is to help in developing collision-avoidance systems for drowsy drivers. The work is under way at the Center for Intelligent Systems Research (CISR), on the Ashburn, Va., USA, campus of George Washington University. Azim Eskandarian is a professor of engineering and applied science and the director of the center, which has research efforts in four separate laboratories, including two complete passenger vehicle and truck driving simulator labs. The author of a number of articles in IEEE publications, Eskandarian is also chair of several sessions at the ITSC 2004 conference. He particularly appreciates the quality of research disseminated through IEEE journals, and the prestige he feels is conferrred when a "respected technical society like the IEEE serves a developing technology," such as ITS.

SPARKING INNOVATION Finding ways to apply ITS is the focus of IEEE Member Hamed Benouar. He is the executive director of the California Center for Innovative Transportation (CCIT), based at the University of California, Berkeley, USA.

"We offer a forum to bring research experts together with government, business and industry people," says Benouar. "We focus on deployment and commercialization of ITS innovations, developing a kind of template for government, university, and industry to follow." Benouar also chairs the group developing short technical courses for ITSC 2004.

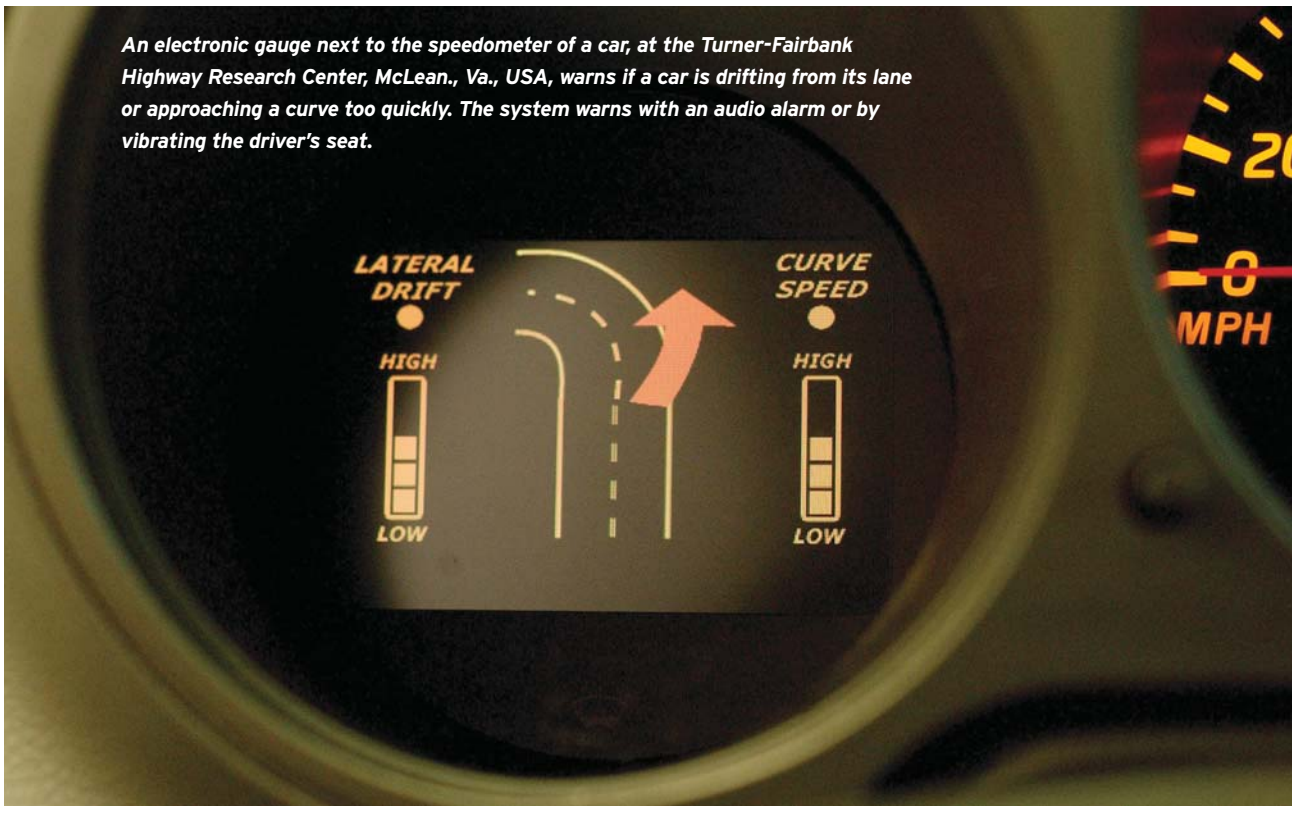
Public policy issues are critical to ITS development. In Europe and Asia, ITS applications have benefited from extensive cooperation between the public and private sectors. But in the United States, where roadways have traditionally been managed by local municipalities and individual states, "the mind-set has been different," says IEEE Member Paul Kostek, chair of ITSC 2004. Replacing this country's fragmented approach to highway management with a more cohesive one is a matter of public policy.

The IEEE provides a TECHNOLOGICAL UMBRELLA for the many disciplines that make up Intelligent Tranportion Systems

One CCIT project is the Berkeley Highway Laboratory, in which a surveillance system is collecting data from a real 10-lane highway nearby with the goal of improving traffic flow. New traffic detectors are being used, including video surveillance and image processing from a 30-story tower just a few meters from the highway.

The IEEE also takes the lead in developing ITS standards through the working groups of its Standards Coordinating Committee, SCC32. One such group, the IEEE Incident Management Working Group, is sponsored by the IEEE Vehicular Technology Society and operates under the auspices of the U.S. Department of Transportation. Among other things, this working group has established standards to define the array of messages that emergency responders use to communicate with each other. Uniformity ensures that a message contains the information that's needed and will be understood by everyone.

To address such policy issues, the Intelligent Transportation Society of America (ITS America) brings together ITS players from industry, government, and academia worldwide. Similar organizations with which ITS America has alliances include ERTICO-ITS Europe and ITS Japan, which covers the Asia-Pacific region. [In Europe, ITS stands for Intelligent Transport Systems and Services.]



An electronic gauge next to the speedometer of a car, at the Turner-Fairbank Highway Research Center, McLean., Va., USA, warns if a car is drifting from its lane or approaching a curve too quickly. The system warns with an audio alarm or by vibrating the driver's seat.

Cooperation of more than just technologists is key to successfully introducing ITS systems into the fabric of existing transportation infrastructure. "Practical solutions need interdisciplinary methodologies combined with the social sciences," says IEEE Member Tsuneo Takahashi, who is also a member of the Japan chapter of the Society of Automotive Engineers.

Takahashi sees a great need for cooperation among ITS players, especially when working toward larger goals. He cites one initiative in particular as a useful model for this sort of cooperation: the Sustainable Mobility Project. Undertaken by the World Business Council of Sustainable Development, in Geneva, Switzerland, this project has automotive manufacturers from around the world working together to mitigate environmental and economic challenges posed by the automobile.

The public's decision to implement some aspects of intelligent transportation systems may also depend upon its societal values, notes IEEE Senior Member Ryerson Case, who represents the IEEE Vehicular Technology Society on the Intelligent Transportation Systems Council. "The technology exists for identifying the position and speed of every vehicle on the road," he says.

Automatic vehicle monitoring systems are already being used by truck and emergency vehicle fleets, and on some private automobiles. Knowing where every vehicle is presents the possibility of substantially reducing urban traffic congestion by charging different tolls at different times to manage demand.

"This possibility raises privacy concerns," says Case. "Drivers see this as the ultimate 'Big Brother.' To really exploit the capabilities of our technologies could require a change in thinking." ●

E-Services Make Members' Lives Easier

BY CAROL GOODALE

A SLEW OF ELECTRONIC services are helping make IEEE members' lives simpler. The services help them to hold meetings, manage Web sites, maintain accurate mailing lists, and control e-mail viruses and spam.

READY TO CONFERENCE With IEEE Internet Conferencing, a group of people of just about any size, and located anywhere in the world, can hold a meeting in real time. All each person needs is a telephone and a computer with an Internet connection. Participants can converse with each other and interact much in the same way as they would in a face-to-face conference: view PowerPoint slides, check flowcharts, and share text files. Last year, nearly 270 meetings were held through IEEE's conferencing service.

The IEEE Professional Communication Society, for example, used the service to conduct its annual 2003 and 2004 administrative committee meetings. Even with participants in Belgium, Canada, Japan, and the Netherlands, the sessions were easy to set up from the United States, says Ed Clark, the society's president.

"The PowerPoint presentations allowed everyone to focus on the topic of discussion," notes Clark. He also found the system's voting function, known as polling, very useful. "When you use telephone conferencing only, it's hard to keep track of how people voted on the issues that came up. When we had to select the recipient of one of our awards, for example, it was very easy for me to type in the nominees' names and have the members vote by just checking on a box next to the candidate's name," Clark explains. The tally was ready when the polling was completed.

Changes being made this year to the conferencing service will make it even simpler to use, says IEEE Web Analyst Lenore Johnson, in Piscataway, N.J., USA, who helps members use the service. In particular, the conference Web site will be easier to navigate for those setting up a meeting for the first time. And it will be easier to upload slides and graphics, as well as to share text files with participants.

As with a teleconference, attendees in the United States call a toll-free number for the audio portion of the conference; those in other countries set up long-distance phone links. Meeting materials like PowerPoint slides are loaded onto the conference Web site by the organizer and the attendees can view the materials from their Web browsers. The charge for setting up a meeting is US$50.

In 2003, nearly 270 MEETINGS WERE HELD through the IEEE's Internet conferencing service

A HOME FOR WEB SITES Finding a permanent home for their IEEE-related Web sites used to be a chore for many IEEE groups. Sites often had to be hosted on university or company servers or even on a member's personal server. But then would come a mad scramble to find a new server if the webmaster changed jobs or no longer wanted a server at home.

Such difficulties ended in 1997 when IEEE Entity Web Hosting offered to house the Web site of any IEEE entity. Last year, more than 1000 sites were using the hosting service, which maintains its servers in the IEEE's data center in Piscataway. The only thing webmasters have to do is create, develop, and update their sites' content.

MASS MAILINGS Maintaining up-to-date mailing lists can be challenging, so last year the IEEE rolled out E-Notice to deal with the problem. An electronic mail service, E-Notice distributes newsletters and meeting notices by e-mail. It uses addresses from the IEEE membership database to maintain a group's mailing list, and to help make sure information goes out on schedule.

E-MAIL ALIASES With more than 99 000 participants, the IEEE Personal E-mail Alias Service is an important electronic service for members. The service provides each member who opts for it a permanent e-mail address. The address, which ends in "ieee.org" won't change no matter how many times a member moves his residence or changes employers. All messages sent to the ieee.org address are forwarded automatically to the e-mail account the member designates.

Each message is scanned for attachments infected with viruses and the viruses are eliminated. In the first three months of this year, the alias service's virus scanner detected 1.8 million messages with infected attachments, surpassing the total for the previous 12 months.

The IEEE e-mail aliases recently received a layer of protection against spam, which is hitting e-mail in-boxes like a tsunami. A spam filter detects what could prove to be unwanted junk e-mail by analyzing its words. This is done at the IEEE server managing the aliases. Each spam message is so identified in the e-mail's subject line before the message is forwarded to the user's in-box. Forewarned, the user can either delete the message immediately or set up a filter that automatically directs it to a folder created for the purpose. The user can then go through the folder and delete—or read—the messages at leisure. In a recent letter about the service, Nelson Segoshi, former IEEE Brazil Council chair, praised the filter's efficiency.

"In just one month, 1300 unsolicited messages were tagged and separated," wrote Segoshi. "This represents almost one hour that I'd lose if I'd had to check, confirm, and delete each one of them during my day at work."

FOR MORE INFORMATION

Internet conferencing: http://www.ieee.org/portal/index.jsp?pageID=corp_level1&path=web/webconf&file=index.xml&xsl=generic.xsl

Entity Web hosting: http://www.ewh.ieee.org

E-mail alias: http://eleccomm.ieee.org

E-Notice: http://www.ieee.org/organizations/vols/e-notice

Spam Filter: http://eleccomm.ieee.org/IEEE-UCE-Service.shtml

Innovation Gains Educator US$500 000

BY PEG GALLOS

THREE DECADES AGO Frank S. Barnes and the late George A. Codding, professors at the University of Colorado at Boulder, USA, proposed the novel concept of combining engineering and nonengineering courses such as law into a single master's degree program.

That simple idea grew into the Interdisciplinary Telecommunications Program (ITP), which earlier this year earned Barnes [photo] the Bernard M. Gordon Prize for Innovation in Engineering and Technology Education from the U.S. National Academy of Engineering (NAE). The award, named after the former chairman of Analogic Corp., Peabody, Mass., USA, recognizes new methods and experiments in education that help develop effective engineering leaders.

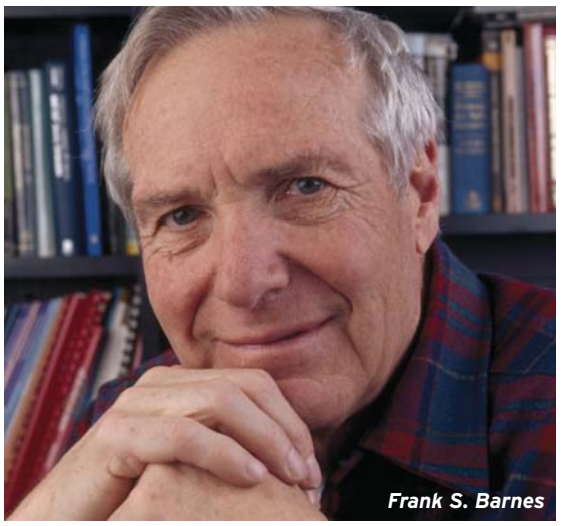
Recipients of the Gordon prize get US$500 000 in cash, half of which is put toward their educational endeavor. Barnes will use $15 000 of his prize, along with the money that goes to the university, to help introduce ITP concepts to the school's civil engineering and other departments.

An IEEE Life Fellow, Barnes is director of ITP and a distinguished professor at the College of Engineering and Applied Science at UC Boulder, where he has held numerous positions since joining the university in 1959, including acting dean of the college.

His and Codding's concept was for students to take electrical engineering and computer science classes along with business, economics, journalism, mass communication, and law courses. The ITP program accepts students with liberal arts, humanities, nonengineering science, business, or law degrees. In short, anyone with a bachelor's degree who seeks a better understanding of telecommunications technology can apply for the ITP master's program.

"Codding and I agreed that political leaders without technical knowledge were making stupid technical decisions, and engineers did not care about the politics," Barnes explains. "But there was a great need for people with knowledge in both areas to help spur the growth of cable television and, as it later turned out, the whole telecommunications industry," Barnes says.

Programs like ITP were unheard of in the early 1970s, but Barnes estimates that his and Codding's innovation has spawned approximately 100 similar programs in the United States alone. ITP offers courses on the technology of connectivity and the Internet, as well as courses on the economic, business, legal, and policy implications of telecommunications. The various colleges in the University of Colorado system all contribute course material. These days, about half the students in the program take their courses from a remote site via the Internet or by watching videotapes. Students, mostly in their 20s and 30s but some near retirement age, work together on course and lab work and research.


Frank S. Barnes

More than 2000 students have graduated from the ITP program since 1972. Many of these graduates now lead major corporations or have helped establish data communications, military command and control, and voice communication systems all over the world. They work for such organizations as the U.S. National Center for Atmospheric Research, Caterpillar, Comsat, and Bank of America.

"I would also like to see a more methodical, carefully planned way of having students teach other students," Barnes adds. "Teaching helps students master the material they learned the year before, and it also helps develop leadership qualities."

Read about four IEEE members who received the NAE's Draper Prize at http://www.ieee.org/theinstitute.

Charles Concordia, Power Pioneer

BY F. PAUL DE MELLO
Recipient of the 2003 IEEE Charles Concordia Power Systems Award

CHARLES CONCORDIA was a great teacher who attacked a problem by getting immediately to its essentials. With a powerful back-of-the-envelope approach, he could quickly come up with a range of possible solutions for problems he faced on the job. I worked with Charlie from 1955 to 1969 in the analytical engineering section of the electric utility engineering operation at General Electric Co. in Schenectady, N.Y., USA, where he was our top consultant.

More recently, despite being 95 years old and nearly blind, Charlie attended the awards ceremony in Toronto last year when I received the first IEEE Charles Concordia Power Systems Award, named in his honor by the IEEE Power Engineering Society. He himself had received the IEEE's highest award, the Medal of Honor, in 1999 for outstanding contributions to power system dynamics.

When Charlie was six years old, his father died. To help support his mother and two brothers, he held several odd jobs in high school, including one as a bill collector. Charlie also took evening classes at Union College in Schenectady and, although still in high school, tutored college students in mathematics.

Convinced that he knew more than many college professors, Charlie decided not to spend four years in college and instead took a job with the GE laboratories in Schenectady when he was 18 years old. GE's management quickly recognized his unusual talents. He was urged to go back to Union College, which he did while still working and where he eventually earned a doctor of science degree.

During Charlie's early years at GE, he undertook a variety of assignments, including developing instrumentation for power systems, testing magnetic materials, and building wind-measuring equipment. After four years in the labs, Charlie enrolled in GE's advanced engineering program, which was offered to the most promising college graduates then finishing the company's test-engineering course. Years later he received an honorary doctorate from the University of Iowa, in Ames, USA.

In the 1940s he pioneered the development of methods for analyzing synchronous and induction machines and their effect on power system stability. He used the latest computational tools available, from network and mechanical differential analyzers to analog computers. His contributions helped advance the work of networking and interconnecting electrical power systems.

Charlie was constantly asked by multiple GE departments, notably the Lynn River Works in Massachusetts, USA, to tackle new problems in system protection, control, and reliability.

Charlie exuded confidence in everything he did. He once told me, "I fancy myself to be someone who knows a little about everything, but not too much about anything specific."

CHARLES CONCORDIA, 95
DIED: 25 December 2003
MEMBER GRADE: Life Fellow
EDUCATION: General Electric Co.'s advanced engineering program, Schenectady, N.Y., USA; doctorate from Union College, also in Schenectady; honorary doctorate from Iowa State University in Ames, USA
FIELD OF INTEREST: Power engineering
CAREER MILESTONES: Employed by General Electric from 1926 until his retirement in 1973
VOLUNTEER ACTIVITIES: Chair of the American Institute of Electrical Engineers Computer Committee, a predecessor of the IEEE Computer Society; cofounder of the Association for Computing Machinery, 1947
AWARDS: GE Coffin Award for contributions to wind tunnel drive analysis, 1942; AIEE Lamme Medal for achievements in developing electrical machinery, 1961; GE Steinmetz Award for technical achievement, 1973; IEEE Centennial Medal, 1984; IEEE Medal of Honor, 1999

Nominations Invited for Technical Field Awards

The IEEE Awards Board seeks nominations for the 2006 IEEE Technical Field Awards. The technical and educational awards, along with their sponsors and scopes, are listed below. The deadline for nominations is 31 January 2005.

For nomination information, visit www.ieee.org/about/awards or contact IEEE Awards Activities, 445 Hoes Lane, Piscataway, N.J., USA 08855-1331; telephone +1 732 562 3841; fax +1 732 981 9019; e-mail, awards@ieee.org.

● **IEEE CLEDO BRUNETTI AWARD** For outstanding contributions to miniaturization in the electronics arts.
Sponsor: *Brunetti Bequest*

● **IEEE COMPONENTS, PACKAGING, AND MANUFACTURING TECHNOLOGY AWARD** For meritorious contributions to the advancement of components, electronic packaging or manufacturing technologies.
Sponsor: *IEEE Components, Packaging, and Manufacturing Technology Society*

● **IEEE CONTROL SYSTEMS AWARD**
For outstanding contributions to control systems engineering, science, or technology.
Sponsor: *IEEE Control Systems Society*

● **IEEE ELECTROMAGNETICS AWARD** For outstanding contributions to electromagnetics in theory, application, or education.
Sponsors: *IEEE Antennas and Propagation, Electromagnetic Compatibility, Geoscience and Remote Sensing, and Microwave Theory and Techniques Societies*

● **IEEE JAMES L. FLANAGAN SPEECH AND AUDIO PROCESSING AWARD** For outstanding contribution to the advancement of speech and/or audio signal processing.
Sponsor: *IEEE Signal Processing Society*

● **IEEE ANDREW S. GROVE AWARD** For outstanding contributions to solid-state devices and technology.
Sponsor: *IEEE Electron Devices Society*

● **IEEE HERMAN HALPERIN ELECTRIC TRANSMISSION AND DISTRIBUTION AWARD** For outstanding contributions to electric transmission and distribution.
Sponsors: *Herman & Edna Halperin and Robert & Ruth Halperin Foundation*

● **IEEE MASARU IBUKA CONSUMER ELECTRONICS AWARD** For outstanding contributions in the field of consumer electronics technology.
Sponsor: *Sony Corp.*

● **IEEE INTERNET AWARD** For exceptional contributions to the advancement of Internet technology for network architecture, mobility, and/or end-use applications.
Sponsor: *Nokia Corp.*

● **IEEE REYNOLD B. JOHNSON INFORMATION STORAGE SYSTEMS AWARD** For outstanding contributions to information storage systems, with emphasis on computer storage systems.
Sponsor: *IBM Almaden Research Center*

● **IEEE RICHARD HAROLD KAUFMANN AWARD**
For outstanding contributions in industrial systems engineering.
Sponsor: *IEEE Industry Applications Society*

● **IEEE JOSEPH F. KEITHLEY AWARD IN INSTRUMENTATION AND MEASUREMENT** For outstanding contributions in electrical measurements.
Sponsor: *Keithley Instruments Inc.*

● **IEEE GUSTAV ROBERT KIRCHHOFF AWARD**
For an outstanding contribution to the fundamentals of any aspect of electronic circuits and systems that has a long-term significance or impact.
Sponsor: *IEEE Circuits and Systems Society*

● **IEEE KOJI KOBAYASHI COMPUTERS AND COMMUNICATIONS AWARD** For outstanding contributions to the integration of computers and communications.
Sponsor: *NEC Corp.*

● **IEEE DANIEL E. NOBLE AWARD**
For outstanding contributions to emerging technologies recognized within recent years.
Sponsor: *Motorola Foundation*

● **IEEE FREDERIK PHILIPS AWARD** For outstanding accomplishments in the management of research and development resulting in effective innovation in the electrical and electronics industry.
Sponsor: *Philips Electronics NV*

● **IEEE PHOTONICS AWARD** For outstanding achievement(s) in photonics.
Sponsor: *IEEE Lasers & Electro-Optics Society*

● **IEEE EMANUEL R. PIORE AWARD** For outstanding contributions in the field of information processing in relation to computer science.
Sponsor: *IEEE Emanuel R. Piore Award Fund*

● **IEEE JUDITH A. RESNIK AWARD** For outstanding contributions to space engineering, within the fields of interest of the IEEE.
Sponsors: *IEEE Aerospace and Electronic Systems, Control Systems, and Engineering in Medicine and Biology Societies*

● **IEEE ROBOTICS & AUTOMATION AWARD**
For contributions in the field of robotics and automation.
Sponsor: *IEEE Robotics & Automation Society*

● **IEEE DAVID SARNOFF AWARD** For exceptional contributions to electronics.
Sponsor: *Sarnoff Corp.*

● **IEEE SOLID-STATE CIRCUITS AWARD**
For outstanding contributions to solid-state circuits.
Sponsor: *IEEE Solid-State Circuits Society*

● **IEEE CHARLES PROTEUS STEINMETZ AWARD**
For exceptional contributions to the development of standards in electrical and electronics engineering.
Sponsor: *IEEE Standards Association*

● **IEEE NIKOLA TESLA AWARD** For outstanding contributions to the generation and utilization of electric power.
Sponsor: *IEEE Power Engineering Society*

● **IEEE KIYO TOMIYASU AWARD** For outstanding early to mid-career contributions to technologies holding the promise of innovative applications.
Sponsor: *Kiyo Tomiyasu Fund*

TEACHING AWARDS

● **IEEE LEON K. KIRCHMAYER GRADUATE TEACHING AWARD** For inspirational teaching of graduate students in the IEEE's fields of interest.
Sponsor: *Leon K. Kirchmayer Memorial Fund*

● **IEEE UNDERGRADUATE TEACHING AWARD**
For inspirational teaching of undergraduate students in the IEEE's fields of interest.
Sponsor: *IEEE Foundation*

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Thanks for Your Contributions

The IEEE wishes to thank those who last year generously contributed US$1.2 million to the IEEE Foundation's philanthropic activities. Gifts to the Foundation support educational programs that help precollege students learn more about engineering, historical exhibits that explain how various technologies have shaped the world, and awards like the IEEE Medal of Honor, for outstanding service to the profession.

Space constraints prevent the listing of all the names of donors to the Foundation. Here are the names of those in the Leadership Association—donors of $1000 or more.

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