IEEE CANDIDATES DEBATE THE ISSUES P. 8

The Institute

http://www.ieee.org/theinstitute

SEPTEMBER 2005 VOL. 29, NO. 3

Steering Students Toward Science And Engineering

BY ROBERT GLUCK

WHEN IT COMES TO reaching out to teenage students and talking up careers in engineering and science, IEEE members around the world are deeply involved. The future of the institute depends on it.

Just ask Costas Stasopoulos, past chair of the IEEE Cyprus Section. Many members of his section participate in preuniversity educational activities, because, he says, they realize the importance of these activities to the engineering profession. Their efforts are directed mainly toward high school students, especially those who have not decided what to study in university. In particular, Cyprus Section members attend career fairs, where they can reach students and their parents.

"We explain what engineers do, we provide information on universities and countries that offer engineering studies, and we explain what courses must be taken," Stasopoulos says. "We also talk about employment opportunities in

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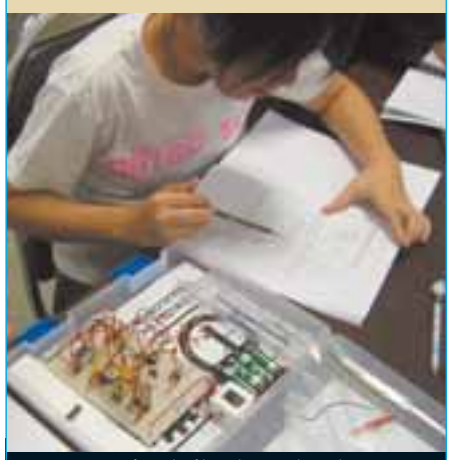


E-campers in Thailand construct simple electronic circuits.

Taking the Pulse Of the Earth

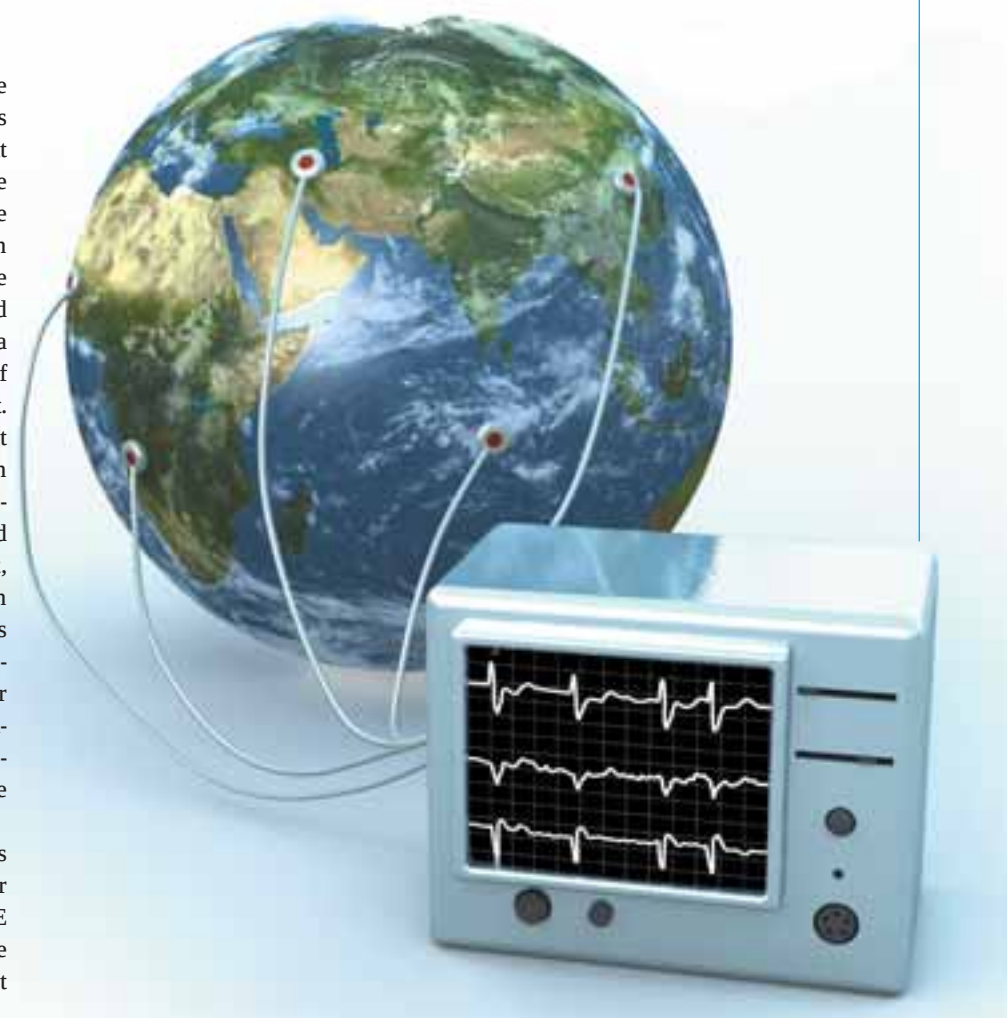
BY BARTON REPPERT

IMAGINE A WORLD in which we can forecast winter weather months in advance, predict where the next outbreak of malaria or West Nile virus is likely to hit, and reduce energy costs by about US $1 billion annually. Suppose we could more effectively forecast climate, drought, and air and water quality. Suppose there was a significant way to quantify the results of our initiatives for sustainable development.

The IEEE has taken on an important role in support of an ambitious 60-nation enterprise to create a worldwide Earth-monitoring network to address those and other issues. The decade-long project, known as the Global Earth Observation System of Systems (GEOSS), involves bringing together data gathered by thousands of gages, sensors, buoys, weather stations, and satellites measuring conditions across the land, oceans, and atmosphere. The project is supported by all the major industrialized nations.

The purpose of all the measurements is to "take the pulse of the planet," says Senior Member Jay Pearlman, chair of the IEEE Committee on Earth Observation (CEO), the group coordinating the IEEE's involvement with GEOSS.

The CEO was formally recognized as an ad hoc committee of the IEEE Technical Activities Board in February 2004, shortly after it was formed. IEEE societies involved with the committee include Aerospace and Electronic Systems, Communications, Computer, Geosciences and Remote Sensing, Oceanic Engineering, and Social Implications of Technology.



A major aim of global monitoring through GEOSS is to help foster sustainable development, often defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The key to such development, Pearlman says, is "having sustainable measurements so that you can reference change over time. GEOSS is designed to integrate measurements and information from all over the world to provide a

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Einstein@Home, an educational program celebrating the centennial of three of Einstein's key papers, is asking for a little of your computer's time.

THE INSTITUTE ONLINE

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Look for these articles on 6 September

HISTORY A hydroelectric plant in St. Louis and electronic particle detectors in Geneva will be named IEEE Milestones.

NEWS Two new councils—for electronic design automation and for systems—are approved.

FEATURED CONFERENCE Learn about the latest in integrated circuits and device design at the inaugural Asia Solid-State Circuits Conference, which is to be held 1 to 3 November in Hsinchu, Taiwan.

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NEWS

FROM AROUND THE IEEE & THE WORLD

Raynes Is New Executive Director

JEFFRY W. RAYNES will be the IEEE's next executive director. He succeeds Daniel J. Senese, who retired in December.

Raynes, 51, will take over the position in November. He will serve as the organization's chief operating officer and will manage the IEEE's staff of approximately 900 employees in several U.S. and overseas locations.

Since 1995, Raynes has served as executive director and chief operating officer of APICS, The Association for Operations Management, in Alexandria, Va. The group is an international educational society for operations management, including issues involving production, inventory, the supply chain, materials management, purchasing, and logistics. The organization has nearly 60 000 members in 20 000 companies around the world.

Before he joined APICS, Raynes was executive vice president and chief executive officer of the North American Die Casting Association, in Wheeling, Ill.; president and chief executive officer of the Better Home Heat Council of Boston; and director of marketing for Association Management Corp., in Springfield, N.J.

"Jeffry's 25 years of experience as a chief staff officer of professional associations makes him a natural fit for the world's largest technical-professional organization," says W. Cleon Anderson, 2005 IEEE President and CEO. "The board and I are confident that his demonstrated expertise in association leadership will help the IEEE to not only meet but exceed the needs and expectations of its members worldwide."

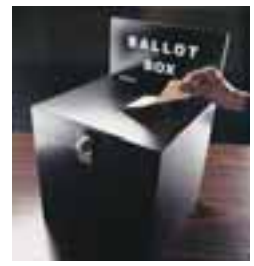
Raynes is a Certified Association Executive and was chairman of the board of the American Society of Association Executives (ASAE) for 2000 and 2001. He was named an ASAE Fellow in 1987. He received a bachelor's degree in liberal arts from the University of Maine in 1976 and is an honorary life member of the board of directors of the University of Maine Alumni Association.

Spectrum Online Goes Way Beyond What's In Print

WEB RADIO BROADCASTS and free access to sample articles from the IEEE's vast online library are just two of the new features to be found on the revamped *IEEE Spectrum* Online Web site. The broadcasts will include in-depth interviews with the experts featured in the print edition of *IEEE Spectrum*, sent as an audio stream to your computer or MP3 player. And for those who want to probe further on a topic covered in *Spectrum*, the online site will offer access to related articles in the IEEE's online library of more than 1 million documents.

In addition, members can get involved with such features as the editor's blog, Web-only seminars on career-oriented topics, and reader polls.

Check out the new *IEEE Spectrum* Online Web site on 1 October at http://www.spectrum.ieee.org.



Time to Vote

THE ANNUAL ELECTION BALLOT will arrive in members' mailboxes this month. In addition to the three candidates for 2006 IEEE President-Elect, 44 others are running in 18 contests for various IEEE offices, including offices in divisions and regions, as well as in the IEEE Standards Association, IEEE Technical Activities, and IEEE-USA.

Those on the ballot represent a diverse group of highly qualified candidates who have the time to devote to their future responsibilities and are dedicated to serving the IEEE membership. Only members whose dues were paid in full and are in the IEEE records on 1 August at Member grade or higher are eligible to vote.

Ballots must be returned by noon U.S. Central Time (18:00 Greenwich Mean Time) on 1 November or the ballots will be invalid. Members can also access the ballot and related materials electronically by following instructions in the mailed package. To find out more, visit the election Web site at http://www.ieee.org/elections.

Dues Up Slightly

BASIC IEEE membership dues for 2006 will rise to US $119, an increase of $3 over this year's dues. The increase is based on the rate of inflation in the United States as measured by the Consumer Price Index.

For U.S. members, the combined assessment for IEEE-USA and the Accreditation Board for Engineering and Technology (ABET) will be $37, an increase of $2. Of that, $34 goes to IEEE-USA and $3 to ABET. Student dues remain at $30 in the United States and Canada, and $25 elsewhere.

The fee for society affiliates, which is set at half the basic IEEE dues, is increasing by $1.50 to $59.50. Affiliates belong to one or more IEEE societies but are not IEEE members and are therefore ineligible for benefits and services. Society affiliates pay the affiliation fee plus the dues charged by each IEEE society they join.

IEEE members and affiliates can renew online at http://www.ieee.org/renewal beginning in mid-September.

Nominate A Colleague For Fellow

IT'S NEVER TOO EARLY to start thinking about nominating a colleague who is a senior member for the 2007 class of IEEE Fellows. Nominating forms are due to the Fellow Committee by 1 March 2006.

The IEEE Fellow grade is conferred by the Board of Directors upon a person with an extraordinary record of accomplishments in any of the IEEE fields of interest. The total number of Fellows selected in any one year cannot exceed one-tenth of 1 percent of the total voting IEEE membership.

To obtain the IEEE Fellow Nomination Kit, visit the IEEE Fellow Activities Web site at http://www.ieee.org/fellows or send a message to fellow-kit@ieee.org.

Revision Proposed To IEEE Code Of Ethics

THE IEEE ETHICS and Member Conduct Committee (EMCC) has recommended to the IEEE Board of Directors that the first declaration of the IEEE Code of Ethics be revised so the wording is more agreeable to members who do not consider themselves engineers.

The new declaration, with the revision italicized, would read that IEEE members agree "to accept responsibility in making *technological* decisions consistent with the safety, health, and welfare of the public, and to disclose promptly factors that might endanger the public or the environment."

The word "technological" is to replace "engineering" so as not to "give the appearance of marginalizing those who are not engineers but nevertheless are dedicated technical professionals," according to the proposal submitted to the board by EMCC Chair Hiromasa Haneda.

Gerald H. Peterson, a member of EMCC, calls the proposed change "simple on the surface" but fundamental in representing the IEEE's broad membership. "This revision was not a casual decision but was one made after full deliberation," he says.

The Board of Directors will consider the proposed revision at its November meeting. Two-thirds of the board must vote for the change for it to pass.

Send comments about the proposed revision to ethics@ieee.org. You can read the IEEE Code of Ethics at http://www.ieee.org/ethics.

—Compiled by Lindsay Elkins

MARKETPLACE OF IDEAS

RESPONSES TO JUNE'S QUESTION

Is a Zero-Tolerance Policy for First-Time Ethical Slipups Too Strict?

Room for Judgment

The basic problem with zero-tolerance laws is that they leave no room for innocent mistakes or misunderstandings. An innocent mistake can easily get a schoolchild expelled, as happened recently when a student got a call on his cellphone from his mother, who was a soldier stationed in Iraq. Students were forbidden to use cellphones, so a teacher ripped the phone away from the student, who became upset and subsequently was suspended. Another example is the teen with asthma who gave his inhaler to a classmate having an attack and may have saved her life. He got in trouble for drug trafficking.

At a company, if an employee finds a document from a competitor that he or she did not realize was stolen, should the employee be fired for working with it? No. The mistake was not in stealing but in not vetting the document to determine if it was stolen. Would it have been reasonable for the employee to do so? Maybe not. One needs to be able to judge what punishment, if any, the mistake warrants.

Zero tolerance, by definition, precludes any judgment. The act and not the intent is the sole criterion, which is why the policy should not be enforced.

BANDIT GANGWERE
Albuquerque, N.M.

Half-Truths or Whole Lies?

We seem to fall into the trap of accepting that whatever is not legally proved wrong is normal and—all too often—desirable. The old saying of "not getting caught in a lie is the same as telling the truth" seems to dominate today's business philosophy and underlies many recent corporate scandals. The problem may be not with a lack of zero-tolerance policies but with leaders who see themselves as exempt from any ethical standards. Zero tolerance can harm innocent workers over minor issues yet never touch the higher-ups. I suggest that we do away with the concept of zero tolerance, and also with leaders who don't lead by example.

JOHN RICHMOND
Pottstown, Pa.

Code Needed

There is unethical and then there is criminal. Zero tolerance may be appropriate for criminal behavior perpetrated in the name of the corporation, but ethics is not a black-and-white issue.

A clearly stated code of ethics should be a part of corporate governance and communicated to every employee. And an ombudsman should be appointed who can be contacted by any employee for a ruling on any ethical issue. This ombudsman must be high enough in the organization that an employee who institutes a charge against the wishes of his or her manager will not face sanctions for doing the right thing. The ombudsman must be someone trusted by all employees, and the whole process must be confidential.

Upholding a zero-tolerance policy is appropriate only if ethical behavior is clearly defined and every employee is trained in the interpretation of the organization's code of ethics.

WALLACE B. BINDER
New Castle, Pa.

What do you think of this decision?

THE U.S. SUPREME COURT unanimously ruled that companies offering Internet file-sharing software may be sued for copyright infringement if they have encouraged their users to illegally download songs, movies, or television programs, even if the software has other, legal uses.

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. Suggestions for questions are welcome. Responses will appear in the December issue of *The Institute* and are subject to editing for brevity.

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LETTERS

A Too-Rosy Picture

From "Investing in Tomorrow's Engineers" [June, p. 4], it appears that the IEEE Educational Activities Board (EAB) has taken on the tasks of re-creating information available elsewhere and of recruiting students into engineering. Though the tasks sound worthy, they seem wrong.

For example, the Web site at http://www.discoverengineering.org already provides lists of engineering societies in different specialties, as well as career guidance, hands-on activities, and other information. Also, there is the EAB Precollege Educators/Engineers Resource site located at http://www.ieee.org/organizations/eab/precollege/peers, which lists resources for educators and engineers that are gateways to more detailed information. Producing such information about gateways is a better pattern for the IEEE to follow, with national and international sites included.

I am also concerned about the IEEE helping to recruit students into engineering, given the poor U.S. job market for engineers. It's one thing to provide general information about the need for strong math and science education and to support preengineering activities. It's also appropriate to discuss preuniversity preparation for engineering careers, aptitude for these professions, and areas of specialization. It is quite another thing for the Web site to paint a rosy picture that inspires students to major in engineering when engineering talent is continually underutilized. I hope that any encouragement to study engineering will be accompanied by current employment statistics for the various majors as well as strategies for having long careers.

Finally, I believe that the EAB should work closely with IEEE regions and IEEE-USA to shape a center that focuses on what is best globally for our profession, our members, and the public good.

LEEARL BRYANT
Richardson, Texas

Member Directory

What members really need is online access to the member directory, and the new portal does not give us that ["New Portal Personalizes Member Information," June, p. 1]. Such access is needed by all volunteers, as well as by the average member. The IEEE used to print a directory every year, so why can't it now be accessible—at least to IEEE members only—online?

BOB DUGGAN
Atlanta

Michael Binder, director of membership, responds: The IEEE Membership Directory was discontinued in 2002 primarily because of cost. IEEE volunteers, however, can still obtain member information for their entities on the Web through the Section/Society Access Membership Information database.

On the other hand, there appears to be significant sentiment for an online version of the directory accessible to all members. A proposal by the Membership Development Committee for such a directory is being reviewed by the Regional Activities Board. I expect to see an online directory made available sometime in 2006.

Post-Tsunami Reconstruction

As president of IEEE-USA, I want to commend *The Institute* for publishing Trudy Bell's article "Engineering Disaster Relief" [June, pp. 10–11], which focuses on the University of Washington's Interdisciplinary Program in Humanitarian Relief and long-term reconstruction. Only months after the tsunami wreaked havoc and caused the deaths of more than a quarter-million people in Southeast Asia and East Africa, the public's attention has drifted to new priorities.

The article's sidebar, "Engineers Aid Post-Tsunami Rebuilding," goes on to describe how Engineers Without Borders (EWB) contributes to mitigating the long-term effects of the tsunami. I am proud of IEEE-USA's support for EWB as part of our organization's coordinating role for the IEEE in Engineers Week (EWeek) and our initiative in spearheading the IEEE's donation to EWB through the United Engineering Foundation. Obviously, much more needs to be done to assist in the reconstruction, and IEEE-USA intends to continue backing EWB through EWeek and other engineering coalition activities in Washington.

GERARD ALPHONSE
Princeton, N.J.

PRESIDENT'S COLUMN **BY CLEON ANDERSON**

"Enough and to Spare"

One privilege of being IEEE President is representing our 365 000 members in meetings with national leaders around the world. This year I had the honor of meeting the president of India, A.P.J. Abdul Kalam, who gave me a copy of his book *India 2020*.

Kalam had dedicated it to a young woman who told him, "I want to live in a developed India." That dream—to live in the developed country of one's birth—is shared by nearly everyone.

I was particularly struck by a provocative paragraph at the beginning of the book: "India is a paradox in many ways. It is rich in natural resources, possesses a thriving industry, and has a large pool of technical manpower, but the large mass of its people are illiterate and poverty-stricken, and in terms of human development indices, it is among the worst-off nations."

Kalam—a noted engineer and scientist—observed that of the roughly 6.5 billion people on our planet, only one in seven have an abundance of clean, drinkable water, and 1 billion more only have access to potable water. The remaining 4.5 billion must drink polluted water, some of it toxic.

Those facts reveal a vital requirement in advancing global prosperity—while also begging the solution, which we hold in our hands as engineers through our creativity and ability to leave a better community, nation, and world with our touch.

What are the most important global prosperity requirements? As I see it, there are several, and they all depend on cheap and abundant electric power:

- Clean air, clean water, and clean food.
- The ability to dispose of all types of waste cleanly and efficiently.
- An expanding population committed to education and technological innovation.

We are the earth's stewards, yet we waste much of its riches. The fact is—to borrow a scriptural quote—the earth is full and there is "enough and to spare." The resources needed to create global prosperity are not really limited. Engineers can use their skills as problem-solvers to not only use resources effectively for the benefit of a living world but also to create resources as well.

For instance, burning fossil fuels has contributed greatly to the current prosperity many enjoy, but engineers also have created nuclear power, which is the most environmentally friendly, and potentially the cheapest, of the major sources of electric power. It is power created by burning a few rocks.

Engineers develop value. Consider this example from Walter E. Williams, Olin Distinguished Professor of Economics at George Mason University in Fairfax, Va. He observed that in 1970 the U.S. telecommunications industry employed 421 000 switchboard operators, who helped Americans make 9.8 billion long-distance calls that year. Today, more than 98 billion long-distance calls are made each year, with 78 000 operators—a decrease in labor of more than 80 percent.

Some would disparage the job loss, but if we had continued with 1970 technology, today's 98 billion telephone calls would require 4.2 million operators, or 3 percent of the U.S. labor force! The loss of operators' jobs is actually great news: global prosperity has advanced while the cost of long-distance calls in the United States has fallen by 60 percent.

Engineers find less expensive ways to produce goods and services, and that frees up labor to develop other things. Indeed, engineers can create resources out of the earth's abundance. For instance, the element silicon is just sand. Yet, silicon transistors are the building blocks of the integrated-circuits industry.

I believe in our IEEE vision—to advance global prosperity by fostering technological innovation, enabling members' careers, and promoting community worldwide. Each of us bears the responsibility to be true to the vision, and to promote prosperity not only for ourselves but also for everyone on our planet. Our challenge is to ensure that everyone can enjoy clean water, clean air, clean food, clean roads, clean clothes, and clean hands.

Rising to meet that challenge exemplifies the nobility of the engineering profession, and those who do so are truly noble men and women.

Yes, the earth is full and there is "enough and to spare." I urge each of you to do your part.

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Taking Pride in the Success of Others

BY ERICA VONDERHEID

IT'S GOOD TO BE WANTED—just ask IEEE Fellow Janie Fouke. She'd been courted by several top-notch U.S. universities before she was enticed away from Michigan State University in East Lansing to become provost and senior vice president for academic affairs at the University of Florida (UF) in Gainesville. She is now part of a new administrative "dream team" at one of the United States' largest universities.

The team's mission is to make this 60-year-old school in central Florida, noted for its football team and parties, into the Harvard University of the South.

UF ranks high in sheer size; it has the fifth largest student body in the United States, with approximately 48 000 undergraduate and graduate students. However, UF President Bernie Machen wants to propel the school to top 10 status academically among public schools. To raise the university's status, Machen gathered his team—11 academic administrators from such leading institutions as the University of Texas–Austin and the University of Utah in Salt Lake City, and from within UF. He wants his school to be as highly regarded for academic excellence as the University of California–Berkeley, the University of Michigan–Ann Arbor, and the University of Virginia in Charlottesville. Each is a public institution, as is UF, and in the top 10 of *U.S. News & World Report*'s overall academic ranking. Currently, UF ranks 16th academically among U.S. public universities on that list.

Fouke is the university's second in command, after the president. She oversees academic policy, which includes developing plans for improving the reputation of several key scholarly disciplines in four of the university's 16 colleges—Liberal Arts and Sciences, Engineering, Medicine, and Agricultural and Life Sciences. She is also charged with expanding UF's research programs in cancer, genetics, aging, biotechnology, and ecology. And as provost, she is responsible for hiring faculty, managing promotion and tenure issues, and mentoring and retaining the best people she can hire.

Other than her high-profile position at the university, which she took on in August —and the fact that she no longer will have to shovel through snowdrifts to get to work—

During two decades in academia, Fouke has seen huge changes in the engineering profession, which she helped document in* Engineering Tomorrow *while she was at Michigan State.

Fouke had another reason to accept. "When I visited the university, the campus just felt *alive*," she says.

ASPIRATIONS When Fouke became dean of the College of Engineering at MSU, in 1999, the college was out to burnish its academic reputation. In six years there, she helped increase the number of faculty in the College of Engineering by more than 20 percent to 152 members, improving the school's student-teacher ratio—previously one of the worst in North America, according to the American Society of Engineering Education. The number of doctoral students doubled to 350, while admission criteria were tightened—which boosted the graduate school's academic reputation.

Fouke and her staff changed the makeup of the college through a reorganization that closed one department and two research centers. Gifts and donations increased by more than 250 percent over five years. With the boost in funds, MSU's College of Engineering opened two new lab facilities and three research centers: the Civil Infrastructure and Computational Fluid Dynamics laboratories, the Design/Manufacturing Learning Center, the Fraunhofer Center for Coatings and Lasers, and the National Center for Pavement Preservation.

Fouke has come a long way since her early days as a public school science teacher in Scotland County, N.C., after she earned a bachelor's degree in biology in 1973. She discovered that being a schoolteacher was not for her, and she went on to earn a master's degree and a doctorate in biomathematics and medical engineering at the University of North Carolina–Chapel Hill. In 1981, Fouke joined Case Western Reserve University in Cleveland, where she taught and researched medical instrument design and development. She concentrated on devices for measuring the mechanical properties of the human respiratory system, and she was named an IEEE Fellow in 2002 for that work.

Fouke has enjoyed several firsts. In 1995, she became the first director of the Bioengineering and Environmental Systems division of the U.S. National Science Foundation, which awards research grants in biomedical engineering. Four years later, she became the first female dean of engineering at MSU.

During her two decades in academia, Fouke has seen huge changes in the engineering profession. She helped document the changes in *Engineering Tomorrow: Today's Technology Experts Envision the Next Century*, a book she edited with Trudy Bell and Dave Dooling (IEEE Press, 2000). The tome considers the past and future role of engineers and scientists through interviews with engineering leaders, such as Gordon Moore, of Moore's law fame. The book did well, winning the Society for the History of Technology's Dexter Prize in 2000 for the best book of the previous three years.

Today's budding engineers must grasp that the pace of technological change is now faster than ever, Fouke says. What is learned in the classroom will not necessarily guarantee a long career.

"Students must recognize that what they learn during their college years is not enough," she says. "What they must take away is the ability to learn and the excitement of learning, which are more important than the information alone." And engineering students must be stronger in verbal, writing, and presentation skills than previously, she says.

IEEE VETERAN Fouke has been an active IEEE member for 20 years.

"As a volunteer, I've had a lot of experience managing other volunteers, overseeing budgets, running meetings, and being accountable for what I said I would do," she says. "These experiences have benefited me enormously."

Fouke served as a member of the IEEE Board of Directors Audit Committee and the Personnel Compensation Committee. She has also been involved with the Ethics and Member Conduct Committee and the Technical Activities Board and served two terms as president of the IEEE Engineering in Medicine and Biology Society, in 1994 and 1995.

She acknowledges the great value of IEEE technical publications, but says the IEEE members she has met through her volunteer work—many of whom have become mentors and friends—are an even greater treasure.

Presidential Preview

THE CANDIDATES TAKE ON THE ISSUES

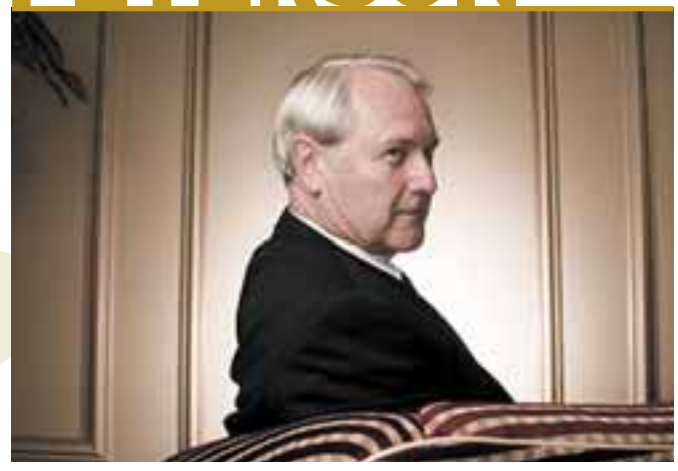
BY ERICA VONDERHEID

LEAH H. JAMIESON, GERALD H. PETERSON, and JAMES M. TIEN, all running for 2006 IEEE President-Elect, delivered their views on outsourcing, continuing education, free access to IEEE publications, and more at a June forum hosted by the Philadelphia Section. Tien recently joined the two Board of Directors–nominated candidates after successfully petitioning to get on the ballot. Each of the candidates hopes to succeed Michael R. Lightner, who will be president in 2006.

James M.
TIEN

"I think we—industry, academia, and the IEEE—all have to help the engineering profession keep up with CHANGING TECHNOLOGY."

Gerald H.
PETERSON



"We need to enrich and preserve what we have of value while moving the IEEE into an EVER-CHANGING FUTURE."

Leah H.
JAMIESON

"As the half-life of technology knowledge continues to shrink, the IEEE needs to become a leader in CONTINUING EDUCATION."

THE 17TH ANNUAL CANDIDATES NIGHT was held at the Sheraton University City Hotel in Philadelphia. The candidates answered written questions from the audience as well as others submitted by readers of *The Institute*. Merrill W. Buckley, 1992 IEEE President, moderated the event. Each candidate had five minutes for opening and closing statements and three minutes to answer each question or group of questions.

★ ★ ★

QUESTION: What is the biggest problem the IEEE faces, and how would you solve it?

TIEN, whose petition was signed by more than 3000 members, said the IEEE's greatest problem is that members don't appreciate how well known and respected the organization is.

"Members have to realize that we have a great franchise," said Tien, who most recently was vice president of IEEE Educational Activities, in 2003 and 2004. "We should all make better use of it to acquire technical knowledge, obtain recognition, enroll in member benefits, and network for jobs."

Tien also noted that in the last five years the computing, electronics, and telecommunications industries have experienced an extended downturn, resulting in layoffs and the technical obsolescence of many IEEE members' knowledge. "As a learned society, the IEEE must lead the way to overcome these and related challenges," he said.

PETERSON said the IEEE's biggest problem—the one that volunteers spend the most time and energy on—is providing "value to members." Many recent college graduates working in industry do not continue their memberships because the IEEE fails to provide enough value for them, said Peterson, the 2003 president of the IEEE Standards Association. "Members' needs and the technological world engineers work in have changed, and the IEEE needs to adapt," he continued. "We need to find the next Internet—the next technology that is going to unite IEEE members, expand the IEEE's fields of interest, and attract future members."

JAMIESON, the vice president of IEEE Publication Services and Products, agreed with Peterson that providing value to members is a key issue, but she said that the institute is slow and ponderous, rather than agile and nimble. "The engineering field changes quickly," she said. "The IEEE has adapted to change slowly, so it has not been quick enough to develop services, products, and activities that are attractive for fields and markets that are changing."

She wants the culture within the IEEE to value entrepreneurship and experimentation. "Over the next five years, the factor having the greatest impact on the IEEE will be our ability to navigate change and turn challenges into opportunities in a rapidly changing world," she said.

QUESTION: How can the IEEE slow the flow of U.S. tech jobs to countries such as India and China?

PETERSON pointed out that the IEEE president represents an international organization, barring him or her from addressing region-specific problems such as outsourcing. Instead, Peterson encourages all IEEE regions to develop ways to meet their members' needs.

"Outsourcing is not a dirty word," he said. "It is the way a free economy works. The company with the lowest price will often get the job, regardless of where the organization is physically located." He depicts outsourcing as a symptom of a larger problem: the United States is not producing enough engineers.

"More than job outsourcing, I worry about the loss of the intellectual capital that has made the United States a dominant player in the world," he said.

JAMIESON said that as industries involving electrical engineering change, it is in the IEEE's best interest to ensure that all engineers have good jobs—regardless of where they live. "We have a responsibility to help our members advance in their careers, and to see that they have current technical knowledge as well as the attributes, such as communication skills, customer focus, and flexibility, that they may not have had when they started working but that are so valuable," she said.

The issue of outsourcing is complicated by the relationship between the IEEE and IEEE-USA. Most countries have an independent national professional engineering organization that looks out for its members' interests. Electrical engineering in the United States has no such organization, so IEEE-USA has stepped in to work for the interests of U.S. engineers, she explained.

"The IEEE is and should be a transnational organization. I think one of the IEEE's challenges is to balance the viewpoints and needs of members in specific countries and regions with the needs of a global organization and profession," Jamieson said.

TIEN urged the IEEE leadership to think and act globally on behalf of the profession but also to think and act locally for its members. As a global organization, the IEEE should not adopt a position on outsourcing, he said, but instead, for example, let IEEE-USA lobby the U.S. Congress on employment issues. Also, the engineering profession needs to create new and better jobs in emerging technologies, he said, predicting that otherwise, engineers will become replaceable commodities.

Tien also wants the engineering profession to recognize that to be well trained, an engineer requires more than a bachelor's degree. "In professions like law or medicine, the bachelor's degree is only the beginning of one's professional education," he said. "Engineers need to enter the workforce with at least a master's degree. If they don't, they are in danger of becoming commodities."

QUESTION: Given that technical information is so essential to the engineering profession, why aren't IEEE publications free to members after a reasonable time?

JAMIESON pointed out that in a sense IEEE articles *are* free. An author may post his or her paper on a personal or corporate Web site, where it would be available for free to anyone. But the agglomeration and organization of all IEEE articles through the IEEE Xplore document delivery system adds value and is not free.

"The open-access movement is young, and the economic implications of offering the IEEE's largest product—the more than 1 million papers in IEEE Xplore—under a fundamentally different business model are not yet known," she said. The open-access movement is a relatively recent campaign to make articles available to all readers for free.

More testing is needed to understand what type of open-access system might work, and what the long-term implications for the IEEE would be, Jamieson said. A few IEEE societies, including the Computer and Information Theory societies, are experimenting with open-access business models for some of their publications. Experiments such as these will help the organization understand how it could change business models in the future.

TIEN pointed out that sales of IEEE publications account for approximately half of the IEEE's revenue and therefore are not something the organization can unilaterally and easily abandon. [For example, total IEEE

revenues reached US $247.5 million for the year ending 31 December 2003.] But the IEEE can lessen its dependence on publication revenues by cutting the cost of producing its journals and considering new sources of income, he said. For example, the IEEE is considering selling tutorials and short courses through a program called Expert Now, an electronic collection of material presented at IEEE technical conferences. Previously known as XELL, Expert Now will be marketed and accessed through Thompson Publishing Group, a global training and educational organization. IEEE societies identify the best courses presented at IEEE conferences—which are then packaged and made available in the Web-based Expert Now learning library.

Tien is against another suggestion that has been made: that authors pay the costs of having their work published so it can be given away for free. "That means that if an author is poor he or she wouldn't be able to afford to publish work through the IEEE," he noted.

PETERSON suggested the IEEE look to the IEEE Standards Association's corporate membership program that allowed free downloads of its popular wireless networking suite of standards, IEEE 802.11 [popularly known as Wi-Fi], six months after its initial publication. He noted that industry members of the IEEE 802.11 working groups had decided that wide dissemination of the new technologies in their new suite of standards took precedence over generating revenue. Industry donations and fees are taking care of lost revenue. Peterson said revenues from all forms of IEEE publications do more than cover costs; they provide a surplus that is used to pay for new programs and invest in reserves.

QUESTION: What will you do to make IEEE publications more relevant to working engineers?

PETERSON conceded that working engineers—those not in research and who do not use higher mathematics and physics daily—cannot understand or make use of some details in articles from an IEEE journal or transaction. He proposed having companies encourage their engineers to submit practical application-oriented articles. That, in turn, could improve the value of IEEE publications to industry, he said.

"As a member from industry, I can say that companies would be motivated to encourage their employees to publish articles if this will show customers that employees are knowledgeable in practical fields," Peterson said.

TIEN pointed out that every IEEE technical society has tried to publish more application-oriented articles, but none has been successful. Perhaps that is because companies are reluctant to have their employees publish articles on potentially proprietary technologies, he said. With respect to Peterson's point that working engineers cannot understand some details in IEEE papers, he suggested the Expert Now collection could be a user-friendly forum for publishing technical information. Industry engineers attend tutorials and short courses at IEEE-sponsored technical conferences because they explain esoteric technical information better, Tien said.

JAMIESON said that she endorses a proposal by John Vig, vice president of Technical Activities, to encourage authors to submit a statement with each paper explaining why the paper is relevant to engineers.

The problem is not solely in choosing among submitted papers, she said, but also in recruiting practicing engineers to write articles. Jamieson suggested working with companies to identify authors who can write well about a particular application or technology.

QUESTION: How can the IEEE increase the number of volunteers in IEEE regions outside the United States?

PETERSON said the IEEE has contributed to the perception that it is too focused on the United States. Many volunteers reach leadership positions by getting involved locally, but to become involved in activities outside their home section they must travel to volunteer meetings, which are disproportionately held in the United States. He suggests using communication technologies, such as the Internet, to hold virtual meetings so all volunteers can participate and avoid costly international travel. He suggests the IEEE become multilingual by translating portions of its Web site and meeting minutes into languages other than English.

JAMIESON cited the transnational "scorecard" that the IEEE Board of Directors is keeping to measure how well members from around the world are represented in leadership positions within the organization. The scorecard also shows that the IEEE holds many technical conferences outside the United States but needs more people from different parts of the world in associate

editorships of publications and in standards working groups. The IEEE also needs more diverse representation on its major boards, such as the Technical Activities and Educational Activities boards.

Most IEEE volunteers become involved because a colleague, mentor, or friend asks them to participate, Jamieson said, adding, "The challenge I pose to all active IEEE volunteers is to invite someone to volunteer, and in doing so, to pay particular attention to diversity of region, gender, age, and ethnicity."

For **TIEN**, a key to regional diversity in the IEEE is language. Because of his extended stays in Brazil, China, and the United States, he jokingly suggested that Portuguese, Chinese, and English be the IEEE's official languages. Tien said he would like to see more section Web sites in local languages. Members reading IEEE information in their native language are more likely to become active in the institute, he said. Moreover, section volunteers should also help the IEEE develop benefits it can offer members outside the United States, to show that the IEEE is not U.S.-centric.

"Section volunteers should figure out what their members are seeking—what their needs are, including benefits—and help them get it," he said. "In this way we'll be able to engage more volunteers and at the same time attract members by providing benefits that meet their needs."

QUESTION: What role should the IEEE play in continuing education?

JAMIESON proposed that, rather than relying on industry or universities, the IEEE should take the lead in developing continuing education programs.

"As the half-life of technology knowledge continues to shrink—it is now estimated to be less than five years—the IEEE needs to become an international leader in continuing education and lifelong learning," she said. "The IEEE has started on this effort, but we need to do much more." She added that the IEEE can draw on its broad base of experts from industry and universities worldwide to provide continuing education in professional and technical skills.

Historically, industry provided continuing education programs for its engineers, she said. That was done, she said, because ensuring that employees were ready to move into a new job was in the company's best interest, but with changing career paths and increased job mobility, industry no longer shoulders the burden. Universities play a role in continuing education, but professional societies need to step up and fill the gap, she said.

TIEN again pointed to the Expert Now program as an example of how the IEEE is assuming a more prominent role in continuing education. He also pointed out that the IEEE Education Partners program gives members discounts on selected courses offered by companies, universities, and other professional societies.

"I think we—industry, academia, government, and professional societies like the IEEE—all have to help the engineering profession keep up with changing technology, especially critical technical knowledge and skills, which need to be reviewed and updated often," Tien said.

PETERSON said he sees continuing education as a collaboration between industry and academia. He praised initiatives such as Expert Now and the Education Partners program. The IEEE can fill the space left by dwindling corporate training, he suggested. "I think Expert Now and the Education Partners program are innovative ways of producing quality training material through collaboration among the IEEE, industry, and academia," he said.

Peterson pointed to the IEEE Standards in Education Task Force, a joint effort of IEEE Educational Activities and the Standards Association. A pilot program will be launched later this year at the Colorado School of Mines, in Golden, and the DeVry Institute of Technology, in North Brunswick, N.J., to help educators incorporate standards into undergraduate programs in electrical and computer engineering.

QUESTION: What is the IEEE doing to promote engineering among the general public, especially youngsters, and are you satisfied with what's being done?

TIEN noted that the Public Awareness and the Pre-College committees of the IEEE Educational Activities Board are developing programs to enhance the quantity, quality, and diversity of students in the engineering pipeline. The best way to attract more students, he said, is to target schoolchildren's

parents, who often strongly influence the career their kids choose.

A poor appreciation of engineers is common in only some countries, such as the United Kingdom and the United States, Tien said. In China, France, Germany, and many other countries, engineers are well regarded and sometimes paid more than doctors.

PETERSON said getting schoolchildren interested in engineering is part of a larger volunteer effort that includes educational outreach programs and linking of popular standards, such as IEEE 802.11, to the institute, to show the value of IEEE membership and engineering to the greater population. "We need to enrich and preserve what we have of value while moving the IEEE into an ever-changing future," he said.

JAMIESON agreed that reaching out to young people is related to the greater problem of raising public awareness about the IEEE and engineering. Our technologies are pervasive, she said, but some technologies, such as nanotechnology and miniature sensors, are "scary to those who don't understand them." She said the IEEE has an obligation to contribute to public awareness and understanding of technology.

"A public educated about our work could generate enthusiasm for engineering among young people and make a difference in how we're able to move forward with projects and research," she continued.

Jamieson said she feels that producing a publication like *IEEE Spectrum*, whose articles can be understood not just by engineers but by the general public, is a step in the right direction.

QUESTION: The IEEE is about to hire a new executive director. What are the main challenges that person will face, and how do you plan to assist him? [See "Raynes is New Executive Director," p. 4.]

"The new executive director has to understand the priorities of volunteers and staff, and create the best possible relationship between the two groups so ideas move forward gracefully and without tension," **JAMIESON** said.

A smooth transition to a new executive director requires open and honest communication. That can ensure the IEEE's new chief operating officer understands the perspectives, values, and insights from across the organization and is able to avoid venturing down blind alleys or into dead ends, Jamieson said.

TIEN emphasized that the new executive director should understand that the IEEE, as a professional association, is not your typical company. "We have volunteers who are very knowledgeable about what they do, and they give a lot of their time," Tien explained. "If the IEEE had to pay for that knowledge, the organization couldn't afford it." He also said he believes the new executive director must be familiar with the electronics, telecommunications, and computer industries to be an effective leader of the IEEE. Tien said he would help the new director in this regard.

PETERSON said the most important job requirement for the new executive director is that the person be able to deal with abstract and strategic problems without getting bogged down in detail. Like Jamieson, Peterson emphasized open communication among volunteers, the new executive director, and staff members, though with the understanding that the volunteer Board of Directors ultimately is in charge.

The new executive director, Peterson said, will have to upgrade the IEEE's Web site—which is the institute's image to the rest of the world—and review the efficiency of the staff.

"I'm not saying the IEEE is overstaffed," he said, "but I think that an organization needs to carefully analyze its staff structure to make sure it is as efficient as possible."

MORE QUESTIONS AND ANSWERS from the forum can be found at http://www.ieee.org/theinstitute. To learn more about the candidates for President-Elect, visit the IEEE election site, http://www.ieee.org/organizations/corporate/candidates.htm.

In addition, each candidate has a Web site. Visit **LEAH JAMIESON** at http://www.ece.purdue.edu/~lhj/IEEE; **GERALD PETERSON** at http://ghpeterson.home.att.net; **JAMES TIEN** at http://www.rpi.edu/~tienj/IEEE/statement.htm.

New Journal Sheds Light on Display Technologies

Colors are bright in a flexible display made of a hybrid of inorganic and organic LEDs by a group at the University of Cincinnati.

BY IVAN BERGER

THERE ARE TWO types of electronic devices: those that have displays and those that soon will. As electronic control spreads to more and more products, the items need displays to tell us what they're doing and what we've commanded them to do. With the market for displays at nearly US $100 billion and rising, and with technology research growing apace, there's a need for the new *Journal of Display Technology*. The quarterly, to be unveiled this month, is being sponsored by seven IEEE societies and the Optical Society of America.

The collaboration between the societies is a natural fit, according to the journal's editor in chief, S.T. Wu, who is a Fellow of both the IEEE and the OSA. Wu, a professor of optics at the University of Central Florida in Orlando, intends the interdisciplinary journal to fill a gap between the short reports in conference proceedings and peer-reviewed journals that cover only specific display technologies. The JDT will cover physics, applications, manufacturing, reliability, and testing. The display types discussed in the inaugural issue include transflective and other liquid-crystal displays, organic and inorganic light-emitting diodes, and a new type of atmospheric-pressure plasma.

SUPERB IMAGES "Organic LEDs have become the darling of future flat-panel displays," says Chin H. ("Fred") Chen, a professor at the Display Institute of the National Chiao Tung University in Hsin-chu, Taiwan, and a contributor to the first issue. Originally restricted to small portable displays, OLEDs, because of their superb display quality, have "great potential for [computer] notebooks, monitors, and eventually for TV," says Chen, who worked at Kodak with Ching Tang, credited as the inventor of OLEDs. For the new journal, Chen's group of researchers at the institute wrote about the development of efficient and robust blue fluorescent OLED materials and devices, critical issues in OLED design, because blue OLEDs have historically suffered from inadequate life and relatively weak color output.

"There are two types of OLEDs," says Yang Yang of the University of California at Los Angeles School of Engineering, "those using polymers and those based on smaller organic molecules. Small-molecule displays are typically made in a high-vacuum chamber." But polymer LEDs can be printed, using an inkjet printer of unusually high precision.

Both display types offer a rich variety of colors, are easy and inexpensive to fabricate, and are emissive like cathode ray tubes, Yang says, noting that his group's JDT paper covers ways of making electrodes "very transparent, so you can see an image from each side—or very opaque, so we can have a high contrast level."

VIBRANT COLORS Combine organic with inorganic LED technology and you get the best of both worlds, says Andrew Steckl, director of the Nanoelectronics Laboratory at the University of Cincinnati. "Inorganic LEDs," Steckl, says, "are very bright and robust but are normally point sources—they cannot be made into large-area sources for flat-panel displays and certain types of lamps. OLEDs are also very bright and can be made into large-area sources at low cost, but they have short life times at the currents required for high brightness."

Steckl, an IEEE Fellow, is a contributor to the JDT's first issue. He notes that in hybrid inorganic/organic displays and solid-state lamps [see photo], "we use an inorganic violet or ultraviolet light source as a pump for organic materials, which absorb the pump light and emit at various visible colors."

The organic lumophores—materials that emit light at specific colors—are optically pumped and do not have electric current flowing in them, lengthening their life, Steckl says. He expects to produce displays with superior performance at lower cost than either liquid-crystal or plasma displays.

Other researchers are pushing ahead with plasma devices. "Plasmas, such as those produced in arc lamps or thermonuclear fusion experiments, have a reputation as being violent or ill-behaved," notes Gary J. Eden, director of the Laboratory for Optical Physics and Engineering at the University of Illinois in Urbana. "But when we shrink them way down to roughly 150 micrometers or less, the result is stable, uniform plasmas compatible with electronic or optical systems."

The smaller the plasma cell, the higher its operating pressure. Make them small enough, and they "can operate all day at atmospheric pressure" rather than at the low pressure required for operating a fluorescent lamp, for example, Eden says. In their journal paper, Eden, an IEEE Fellow, and his team describe microcavity plasma devices, "plasmas on a chip," at atmospheric pressure. The Illinois researchers have developed tools for etching pyramidal cavities in silicon, coating their walls with a dielectric, surrounding the cavities with a second electrode, and sealing the system with a transparent window. The technology is adaptable to very thin and flexible displays that can be rolled up.

The microcavity approach also increases light output. "Because of the pressure, specific power loading is very high," Eden says. "You are dissipating kilowatts of power per cubic centimeter, but you have very few cubic centimeters—nanoliters—per pixel."

When will the technology be commercial? "It already is," Eden says. "A former student of mine formed Caviton Inc., in Champaign, Ill., for environmental sensors. That's the opposite of display, but microplasma helps make those sensors very light, portable, and sensitive."

FOR MORE on the new display journal, visit http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=9425.

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unified picture and to allow global access and sharing."

Pearlman, chief of technology for network-centric operations, programs, and technologies at Phantom Works in Seattle, the research and technology arm of Boeing Co., took the lead in creating the CEO as a focal point for the IEEE in interacting with the Group on Earth Observations (GEO). The GEO is the intergovernmental organization that drafted the implementation plan for GEOSS. Pearlman says he views the project as "an important step forward in understanding the Earth's environment—making it quantitative and providing a basis for sound management and environmental decisions."

THE KICKOFF GEOSS was formally inaugurated at the third Earth Observation Summit in February in Brussels, Belgium. IEEE President-Elect Michael R. Lightner noted at the time that the institute was invited to be an official participant—one of 43 international organizations—because it "brings expertise through its members and societies in a wide range of relevant technologies, in internationally recognized standards development, and in a broad base of educational activities."

The IEEE, in partnership with the Open Geospatial Consortium in Wayland, Mass., and the International Society for Photogrammetry and Remote Sensing in Istanbul, Turkey, sponsored the first in a series of workshops to explain to users the architecture of the system for collecting global data. The workshop was held on 24 July in Seoul, South Korea, in conjunction with this year's International Geoscience and Remote Sensing Symposium (IGARSS 2005). Experts from Australia, Canada, China, Japan, Malaysia, Taiwan, the United States, and other countries spoke at the session. Further information about the workshop is available at http://www.grss-ieee.org.

The value of GEOSS was underscored in a statement issued on 1 July by Conrad C. Lautenbacher Jr., administrator of the U.S. National Oceanographic and Atmospheric Administration (NOAA). Lautenbacher observed that GEOSS "will integrate many thousands of individual technological resources now demonstrating their value around the globe into one comprehensive, sustained system. Earth-science technology finally will become as integrated as the planet it observes. Over time, GEOSS's benefits will be as broad as the planet itself."

In a keynote address given in June at the IEEE International Symposium on Global Data Interoperability, in Sardinia, Italy, the NOAA chief said, "No matter how effective and efficient all our single-purpose systems may be, their value will be much greater when they can work together—when they are interoperable. This approach goes to the heart of GEOSS, both in the way we can build our data- and other information-sharing capabilities, and in the way we are creating the political will to support GEOSS."

The GEOSS concept has its foundation in international discussions at the 2002 World Summit on Sustainable Development held in Johannesburg, South Africa.

Earth-science technology will be as integrated as THE PLANET it observes

The IEEE's involvement with sustainable development began as far back as 1972 with the formation of a committee that subsequently became the Society for Social Implications of Technology (SSIT). It now has about 2000 members concerned with issues including environmental, health, and safety implications of technology, and engineering and social issues related to energy, information tech-

[Continued on page 16]

Egyptian students design a three-dimensional model for the IEEE Future City Competition.

Cyprus and in the European Union. And, of course, we answer questions." At some fairs, he says, Cyprus Section members talk to hundreds of people.

A key outreach event for the section was held on 26 June in Limassol in conjunction with the department of electrical engineering at the University of Cyprus. "We invited high school girls and gave them information regarding careers in science and engineering," Stasopoulos says. "The program included a panel of successful female engineers who talked about their experiences and answered the girls' questions." There were also exhibits that focused on careers in robotics and bioengineering.

BOOT CAMP Perhaps no section is more serious about its outreach activities than the one in Thailand. Its main preuniversity effort is what its leaders call an electronics boot camp, better known as E-camp, that runs for four days.

"Members teach basic electronics, and we visit research laboratories on the CU [Chulalongkorn University] campus such as the robotics and IC design lab," says the camp's chief organizer, IEEE Member Ekachai Leelarasmee. The Bangkok university's student branch helps Leelarasmee run the camp. "Electronics is a convenient subject to teach because it requires simple components and equipment," Leelarasmee says.

The high school students work with prototyping boards to breadboard simple electronic circuits such as oscillators, counters, and number displays. They also solder together electronic kits. The Thailand Section has organized the annual event for four consecutive years. Fifty students from 15 schools around Bangkok attended this year, from 22 to 25 March. "It's a totally free camp, including meals and lodging," Leelarasmee says. "The students stay on the university campus."

Leelarasmee says the next E-camp will be held in October.

ROBOTS 101 In the Panama Section, IEEE members have centered their approach on robots. Members organize a five-hour program in which lectures take about 90 minutes, with the remaining time dedicated to workshops. The program shows young people the value of engineers and engineering. "Our young people live surrounded by technology, but they do not know how gadgets work, and therefore they do not value creative effort," IEEE Senior Member Roman Altamiranda says. "Our intention is to teach them that technology and engineering are of value when they make our lives better."

The study of robotics lends itself to making that kind of impression. Lectures introduce the youngsters to the basics, including the definition of robots, and their history and applications. "Then we have the children work on an activity that shows the practical applications of engineering," says Altamiranda, who is past chair of the IEEE Panama Section.

For the students, the highlight of the day is working with a Stiquito robot that, Altamiranda says, "youngsters love to learn about." The Stiquito is a six-legged robot used worldwide at all grade levels, including university, as a tool for teaching basic science and engineering principles. It is sold by the IEEE Computer Society in US $62 kits with an instruction book, or $15 for the kit alone. The kit is simple to assemble, with its robot relying for movement not on electric motors but on so-called muscle, or nitinol, wires. Made of a nickel-titanium alloy, they expand or contract depending on the voltage that's applied to them.

Altamiranda also invites working engineers to speak to the students, who are in grades 7 through 9. Guest lecturers have included computer specialists from the Smithsonian Tropical Research Institute in Panama, representatives of the country's Public Works Ministry, and the engineering school director from Santa Maria La Antigua University.

"Our young students live surrounded by comforts that owe their origins to engineering," Altamiranda says. "Institutions like the IEEE must deliver educational programs so that more students will be aware of this and come to love science and engineering."

FUTURE CITY IN EGYPT Preuniversity programs are just getting started in Egypt, and they face the challenge of finding sponsors. "The IEEE in Egypt has no budget for school programs," says Member Yasser Tawfik. "The IEEE Graduates of the Last Decade Group, better known as GOLD, in Egypt is trying to raise awareness among companies and different sponsors about the need to fund school programs, and more needs to be done."

But the section has made a mark with the little that has been available. Organizers of the IEEE Future City Competition sent the Egypt Section 10 software kits. Based on the hands-on activities of designing and building a functioning city, the competition aims to teach students essential skills that include creative thinking, planning, teamwork, and presentation techniques.

At first, Tawfik doubted that Egyptian students, for whom the project was a new activity, could design three-dimensional models. But the IEEE student branch in Alexandria worked successfully with a team of five high school students to design a city and then to build the 3-D model.

Although only a small group of students was involved, the team garnered attention from the local news media. "Our team's ideas were shown on television and written about in newspaper and magazine articles," Tawfik says. "We hope that potential sponsors saw us or read about us so that they might consider funding a larger competition in the future."

Tawfik says that if IEEE GOLD in Egypt gets more funding, it will organize a larger competition between schools instead of a competition with just a handful of students.

In the final analysis, whether it's working with students to build robots or other 3-D models, or holding lectures or panel discussions, helping youngsters to get turned on to engineering is a vital activity. There are always young men and women just waiting to be nudged in the right direction. ●

FOR MORE INFORMATION on other IEEE sections' preuniversity activities visit http://www.ieee.org/education.

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nology, and telecommunications.

"To the extent that engineers are designers, we're all interested in creating designs that don't have unintended adverse consequences," says Clint Andrews, an IEEE senior member who served as president of the SSIT in 2002 and 2003. "Part of what's going on with sustainable development is to give engineers some additional design criteria. This is so they will consider not only the business dimensions of a design but also the social and environmental implications."

For sustainable development, engineers consider a design's SOCIAL AND ENVIRONMENTAL implications

Up to now the goal of engineering with sustainability in mind has attained more mainstream acceptance in Europe and Japan than in the United States, according to Andrews, who is an associate professor at the Bloustein School of Planning and Public Policy, Rutgers University, in New Brunswick, N.J. For example, he says that at the annual conference of the International Society for Industrial Ecology, "you see a lot of American academics but relatively few American engineers from the private sector." However, there are a lot of practicing engineers from Europe and Japan at the conference, he says.

IEEE activities related to sustainable development expanded in the early 1990s with the establishment of the Technical Committee on Electronics and the Environment (TCEE), whose focus is on the effects of electromagnetic emissions from wireless communications equipment, the environmental hazards of electronic waste, and other problems. Since 1993 the TCEE has sponsored the annual Symposium on Electronics and the Environment, the most recent of which was held from 16 to 19 May in New Orleans.

"Our position is that good design is environmentally appropriate design—the two are not different," says Brad Allenby, an IEEE member who has been active with the TCEE since the committee's inception. A former AT&T vice president for environment, health, and safety and now professor of civil and environmental engineering at Arizona State University in Tempe, Allenby says that "once you integrate environment into your design process, it doesn't mean that environment always dominates the design, because everything else you've got to design to is still there. You've still got competitive issues, cost issues, material availability, and marketplace windows. What you've done is add environment as an important part of the design process."

Allenby is currently president of the International Society for Industrial Ecology, which is interested in working with the IEEE on such issues.

Design for the environment is, of course, a major goal behind the GEOSS project. Pearlman notes that including the environment in the design process, especially when finding sites for wind turbines and renewable energy facilities, "will make the engineering more effective in the long term."

To help shape a community where engineers from various disciplines can share ideas, information, and best practices, the IEEE's Web site recently started hosting the IEEE Sustainable Development Forum, at http://www.ieee.org/communities/sd. Online discussions could include areas such as energy conservation, recycling, and reuse; sustainable technology for developing countries; control of hazardous materials; environmental standards and regulations; and renewable energy development. It is also hoped that forum participants will collaborate on setting up conferences and workshops and will develop publications and standards.

Electrotechnology's Long Green Streak

BY ROBERT COLBURN, *IEEE HISTORY CENTER*

Palmer C. Putnam's 1.5 MW wind generator near Rutland, Vt., in about 1941.

ELECTRICITY'S GREEN roots run deep, starting with one of its earliest applications: the incandescent lamp. The lamp was a welcome advance, and not just for its light. In 1893, architect Frank T. Lent described electric incandescent light as "the acme of all methods of lighting... never impairing the air in a room." Electric light was a clean, safe alternative to the gas that was being used to light businesses and homes. Gas was sooty, consumed oxygen, and released carbonic acid into the air, damaging books, curtains, and carpets.

"Smoke, ashes, and cinders are unknown because electricity is used now for which formerly fires had to be built," novelist Solomon Schindler wrote in 1894. That was not entirely true; coal-fired stations still generated most of the electricity. Although generating power centrally back then does not qualify as green by today's standards, it was less harmful to the environment than the scores of dispersed coal-burning furnaces would have been. In the 19th century, factories were clustered in cities, instead of—as nowadays—outside of them, so clean power sources were a civic necessity. Steam replaced water power as the primary source of energy used by industries in the United States and Europe, and that resulted in grimy, smoke-shrouded cities.

But rural areas were not immune from the grit and grime that were by-products of steam-powered energy. Steam locomotives brought noise, cinders, and smoke from the city to the countryside. Electrifying the railroads was a natural—not to mention clean—early application of electrical technologies. Electric traction first replaced horse-drawn trolleys (offering advantages in speed and sanitation) and later took the place of steam-powered engines. Boston electrified its transit system in 1889, a development worthy in modern times of an IEEE Milestone award. (IEEE Milestone awards are administered by the IEEE History Center to honor significant achievements in electrical, electronic, and computer engineering.)

The first lines of London's Underground railway ran coke-fired locomotives (coke fumes are toxic), then quickly switched to coal-fired steam trains. Venting the tunnels merely shifted the problem. With every train passing underground, smoke puffed up through vents at street level, begriming pedestrians and startling horses. By 1905, those lines of the London Underground originally built for steam had been electrified.

The 1907 electrification of the New York City to Stamford, Conn., portion of the New York, New Haven, and Hartford Railroad demonstrated that long-distance electric traction was feasible. The electrification of the New York to Stamford rail line received an IEEE Milestone award.

RENEWABLES Wind generation—a truly renewable source of electricity—was first explored in the 19th century. In 1887, Charles Brush, a Fellow of the American Institute of Electrical Engineers, one of the IEEE's predecessor societies, began building a 12 000-watt direct-current, wind-driven generator on the grounds of his mansion in Cleveland. Brush invented both the arc lamp, which produces light when a spark jumps a gap in a wire, and the Brush dynamo, an electromechanical generator to power it. The wind generator, its storage batteries, and voltage regulation were considered state of the art for the time. *Scientific American* featured Brush's equipment on its 20 December 1890 cover. Brush dismantled the device himself in 1908 after 20 years of service.

In 1933, V.N. Krasnovsky built a 100-kilowatt, three-blade wind generator in Crimea, then part of the Soviet Union. Its three-phase alternating current could be integrated with the local power network. Engineers planned to build multiple generators to be used as a wind station, but World War II intervened and halted their work.

Inspired by Krasnovsky's achievement, Palmer C. Putnam in the United States designed and built an enormous 1.5-megawatt wind generator in 1941 on Grandpa's Knob near Rutland, Vt. [see photo]. Putnam's turbine demonstrated that a wind-powered generator could supply large amounts of power to a commercial network. When a broken blade could not be repaired because of wartime material shortages, the turbine ceased operations in March 1945.

Another Milestone award went to a water-power facility. Hydroelectric energy initially was considered clean and renewable. The Georgetown, Colo., hydroelectric generating plant, which opened in 1900 and is still operating, achieved its 200-meter "head" not from a dam but from the natural height of the stream flowing down a mountain slope above the plant. An intake valve diverted water from the stream to the plant's Pelton turbine and 750 kW generator. Originally Georgetown was built as a hybrid, with coal-fired boilers to generate power when the stream was low. In 1918, the boilers were removed because of the high cost of coal. One hundred years later, electrical engineers are still designing low-impact hydroelectric plants such as those used at Georgetown.

TO READ MORE about IEEE Milestones, visit http://www.ieee.org/organizations/history_center.

Psst!

Want to make a contribution to pioneering physics?

SEARCHING FOR GRAVITY @HOME

BY TRUDY E. BELL

Do you enjoy friendly competition?

Want a jazzy screen saver?

Then have I got the project for you!

EINSTEIN@HOME asks that you lend the idle CPU time of your home or work computer to physicists and astronomers now searching the sky for evidence of gravitational waves. The waves could result from stars exploding, black holes engulfing each other, or other acts of astronomical violence.

I got hooked on helping in late January when I showed up early in a California Institute of Technology laboratory of a physicist whom I was to interview for an article on gravitational waves. While waiting in the Pasadena lab, I noticed that all the computer screens displayed a gorgeous rotating celestial sphere [see illustration, opposite] that looked so three-dimensional I felt I could reach inside it. "Where'd you get the neat screen saver?" I asked when my interviewee appeared. "I want one."

That's exactly what physicists are hoping to hear.

"We wanted something pretty that moves, to attract 100 000 people to the Einstein@Home project," explains IEEE Member Bruce Allen, professor at the University of Wisconsin at Milwaukee, who conceived and designed the screen saver.

Einstein@Home is the flagship public education and outreach project of the American Physical Society. The APS is now celebrating the World Year of Physics 2005 to commemorate the centennial of Albert Einstein's "miracle year" of 1905, when he wrote three key papers fundamental to modern physics, including his first on relativity. "We wanted something that teachers could use at school, to show the celestial sphere, and that kids would then want at home to run on their parents' computers," says APS spokesman James Riordon.

REAL PHYSICS But Einstein@Home is far more than a public relations project to raise awareness of physics. It's real physics itself. Download the screen saver, and you're also downloading a program that will calculate whether any direct evidence of gravitational waves can be discerned in the raw data obtained from the Laser Interferometer Gravitational-Wave Observatory (LIGO) project. The observatory's telescopes (one in Hanford, Wash., and the other in Livingston, La.) will begin full-time operation late this year.

Gravitational waves are predicted by Einstein's general theory of relativity. Einstein said that what we feel as a gravitational field actually results from the fact that huge masses (such as the earth and stars) curve the very geometry of space and time. The more massive an object is, the more it bends space and time—something other bodies sense as a greater gravitational field. And if the object's gravitational field changes—say, when a star explodes or one black hole engulfs another—then that change literally propagates as a ripple, or wave, through space and time, rather like ripples radiating outward in a pond from a disturbance in the water. These ripples in the geometry of space-time are the gravitational waves LIGO is trying to measure.

But you don't need to know about exotic physics to understand or appreciate Einstein@Home. The basic principle is "many hands make light work"—and at lower cost.

Looking for evidence of gravitational waves is similar to the challenge of searching for signals from extraterrestrial intelligence: physicists have no idea what kind of signal to expect, or at what frequencies, or from where in the sky it might come. So they are faced with examining all points in the sky at all frequencies for as long as possible. That makes for a monumental task of truly daunting proportions, requiring millions of hours of computing.

But it also is a problem of a form that mathematicians call "trivially parallel"—meaning that each calculation at a particular frequency or point in the sky is completely independent from any other calculation at another frequency or point in the sky. Thus, individual calculations can be readily parceled out to independent machines, as has been done by enlisting 3 million helpers in the University of California at Berkeley's SETI@Home project, searching for extraterrestrial intelligence since 1999. (Sorry, no extraterrestrial signals have yet been found.)

The software for Einstein@Home is called BOINC, a whimsical acronym for Berkeley Open Infrastructure for Network Computing. It's the brainchild of IEEE Member David Anderson, project director at the Space Sciences Laboratory at Cal-Berkeley. Effectively, BOINC unites PC, Macintosh, and Unix machines around the world into one massive supercomputer for Einstein@Home. BOINC is also being used by SETI@Home and about half a dozen other massively parallel computing projects.

"The long-term goal of BOINC is to get everybody in the world directly involved in volunteer computing for science," Anderson says. The potential numbers are impressive. According to Anderson, there are 200 million privately owned personal computers connected to the Internet. Worldwide, that's a phenomenal amount of computing power that is often idle and could be harnessed for science.

Even for Einstein@Home, the newest BOINC project, the numbers are already big. Since going public in mid-February, Einstein@Home now has some 45 000 participants, whose collective computers have more than 20 times the power of LIGO's own machines.

Not only are the volunteer computers handling 20 times as much data as LIGO can for itself, but BOINC also is saving LIGO big bucks. "The average PC draws 100 to 150 watts, so 45 000 computers are burning about 6 megawatts," Allen estimates. "At Wisconsin electric power rates, that's saving the LIGO project US $7000 a day. Plus people are keeping an eye on their machines, saving LIGO the cost of maintenance."

THE PAYOFF What's in it for you? Aside from the hypnotically peaceful screen saver, it's just plain fun watching your credits mount. Credits are an arcane dimensionless indication of how much of a contribution your computer has made to the project; every time your computer dials out to upload its results and download new raw data from Einstein@Home, the number jumps (my credits now top 50 000).

"Credits are like Monopoly money," Allen explains. "People get very competitive and are excited to see how they stand compared with other participants." Encouraging whatever psychology works to keep people and their computers involved, the Einstein@Home site regularly updates statistics on individual computers and even teams of participants, invites participants to create their own Web pages, and explains the individual work your own computer is calculating.

If one day LIGO detects gravitational waves, what do Einstein@Home participants get—a share of a Nobel Prize? A bottle of wine? An acknowledgment in a scientific paper? "In the end, you get a number: your credits, which give you a feel for your level of participation in the project," Allen says, "and the knowledge in your heart that you directly contributed to pioneering physics."

FOR MORE INFORMATION about the Einstein@Home project, visit http://www.einsteinathome.org. Details about the World Year of Physics 2005 are at http://www.physics2005.org.

More about BOINC is available at http://boinc.berkeley.edu.

Fund-raising Fundamentals

BY ERICA VONDERHEID

NEED MONEY to run your section, chapter, or student branch? Consider some of the approaches taken by the following IEEE units. While they may not have the Midas touch, exactly, they have successfully organized events that have raised thousands of dollars.

The Oregon Section raises money by holding technical conferences, probably the most common fund-raisers within the IEEE. Twice a year Oregon holds a one-day workshop on wireless networking topics, which are of great interest to many members employed by companies in the state. A workshop held in 2002 that covered wireless networking standards attracted 95 attendees and took in about US $20 000.

To hold down travel expenses, the section invited speakers from nearby companies. It also got a low rate for a meeting room: Portland State University charged the group $100. Other costs included audiovisual equipment for making presentations and printing expenses for technical papers and study materials. Those items plus continental breakfasts, lunches, and coffee breaks added about $2500 to the total.

The Oregon Section uses the profits from the two conferences to support activities of their local technical society chapters. For example, through their society chapters the Oregon Section holds short, focused technical meetings at no charge to members.

Organizing fund-raising events brings in NEW VOLUNTEERS and generates a feeling of success

"Sections must raise money because the funds they get from the IEEE Regional Activities Board [which oversees all sections] is just enough for bare-bones operations," says Edward Perkins, chair of the Oregon Section. The Regional Activities Board provides each section with annual payments of $2000 plus $3 per member and $4 per senior member and Fellow on the section roster. Chapters (local subsets of IEEE societies) and student branches, in turn, receive funds from the sections—$200 for each technical chapter and $3 per student member. Chapters may also receive funding from their parent societies

The IEEE Victorian Section in Australia, which also holds conferences to raise money, is helping to produce Tencon 2005, the only conference organized by Region 10 (Asia and the Pacific). A different section holds the conference each year.

Now in its 25th year, the conference was developed to attract IEEE members of many different specialties, so it covers a wide scope, with topics ranging from chip design to biomedical engineering. Organizers hope to draw at least 350 people to this year's event, which runs from 21 to 24 November in Melbourne. The registration fees range from $600 to $750, with discounts for early registration. The Victorian Section receives two-thirds of the surplus; the region gets the rest.

Victorian Section Chair Enn Vinnal cautions not to overlook anything when making plans for your conference. Fees must cover all costs, including space rentals, food, speakers' fees and travel, and even goodie bags with pens and bookmarks.

Vinnal also cites the importance of planning well ahead of time. Meeting venues often require a deposit a year or more in advance, and would-be speakers might have busy schedules. Line up sponsorships early. The money can be used for things like additional luncheons or better coffee breaks or meals.

Victorian Section volunteers have also found that organizing a major technical conference offers benefits besides raising funds. "The section as a whole rallies together," Vinnal says. "A conference brings in new volunteers, raises the section's profile, and—when things go really well—you get an amazing feeling of success."

The IEEE Houston Section uses golf, an activity enjoyed by many engineers, to raise money. For the last three years, the section has hosted a tournament at a local course to raise money for five $1000 scholarships awarded for academic excellence to section members' children. A $400 payment from the golfers themselves covers the greens fees for a team of four playing 18 holes.

COUNTING ON SPONSORS The profit comes from local companies that pay from $500 to $1500 to sponsor either a hole or a break cart. In return, says Donald Dunn, past section chair, a company's name and logo are featured on a banner at that hole and at the closing luncheon. The most recent tournament, in October 2004, raised $5800.

Sometimes corporate sponsors carry most of the cost of an event. For example, the joint chapter of the IEEE Communications and Vehicular Technology Society in Dallas—known as the CVT—charges members only $5 for its popular monthly lunchtime networking meetings; sponsors pay the rest. Invited speakers talk about technology or career topics. The low registration fee doesn't cover the cost of the luncheon, but it attracts a lot of members and nonmembers alike.

"It helps when soliciting sponsorships to recognize how valuable your organization is to an outsider," says Chuck Sobey, chair of the industrial relations committee at the CVT. Companies benefit by having their names in front of a large group of smart, well-paid individuals, he says. In exchange for fees that can range as high as $5000, sponsors are thanked by chapter officers during the technical or career presentations at meetings. The chapter's Web site also displays sponsors' names and logos. Sobey emphasizes, however, that the chapter does not allow a company to give a marketing pitch.

Corporate sponsors sometimes offer more than money. The IEEE student branch at the State University of New York at Buffalo asked for help in judging events at the annual IEEE Region 1 Student Conference, reports former branch Chair Nitin Mistry. Sponsors—including Fisher-Price, the toy manufacturer, and Niagara Mohawk, the local power-distribution company—were asked to judge student papers and a micromouse competition during a two-day event held in April. For the micromouse contest, contestants design and build an electromechanical device, or mouse, that must navigate a maze on its own. The mouse that does it fastest wins.

"When the companies realized we weren't just asking for money, they were very open to helping us out," Mistry says. The $20 000 of sponsorship money, incidentally, covered venue and audiovisual rental fees and provided food and lodging for the 100 or so students who attended the conference from all over the northeastern United States.

FIND MORE INFORMATION about organizing a conference at http://ieee.org/organizations/tab/BestPract_1.htm.

So Now You Are A Manager

BY ROBERT GLUCK

NOT ALL ENGINEERS promoted to management love the job, and some don't like it at all. The likely reason for dissatisfaction is a lack of training, according to IEEE Fellow Gus Gaynor.

Most people enter management ranks without much preparation, Gaynor points out. "There are significant responsibilities to becoming a manager, but naming someone is often thought of as a trivial decision," he says. But "it's the manager who determines whether the organizational units serve the organization well or whether they squander talent and resources."

New managers should realize that they don't have to know everything at once. "Mastering the managerial role is a continuous learning process," Gaynor says. "You make mistakes, you learn from them, you own up to them. You build a track record one step at a time, and you provide leadership, or as I prefer to say, 'you take the lead.' You read, you listen, you show respect to all people, you meet your commitments, you don't make excuses and, if necessary, you take the blame."

Gaynor draws on the experience he gained while in management positions for 25 years at 3M Co., as well as by being the principal of his own company, G.H. Gaynor and Associates, a technology management consulting firm in Minneapolis. He is the author of *What Every Manager Needs to Know: Making a Successful Transition to Management* (American Management Association, 2004).

At first, Gaynor says, he was going to target his book at the technical community, but his editor suggested he expand it to include all managers because they all face similar problems. All managers must learn the importance of communicating effectively, building relationships, using time efficiently, and seeing the big picture. Above all, Gaynor says, managers must recognize the importance of wearing their "people hat."

"Managers accomplish their unit's goals through people," he says. "If managers think they can do it independently, they fail. They must make sure their staff is well trained and rewarded. They also must develop individual contributors as well as team players."

A fault of many engineers who become managers is that they require too much information before they'll make a decision. "Decision-making is about choices. We never have all the information we need," Gaynor says. He suggests following the 80/20 rule: "You can get 80 percent of the information in 20 percent of the time or with 20 percent of the effort. Make a decision based on that 80 percent. You can't wait for 100 percent of the information to arrive."

BUILDING TEAMS Wearing a people hat has been a specialty of Michael Aucoin, an IEEE senior member, because he has spent so much time organizing and motivating teams of engineers. Aucoin is president of Electrical Expert Inc., in College Station, Texas, a consultant primarily to the electric power industry. Much of his career has been spent in research and development and in managing technology projects.

"The single most important thing I've learned about management is the incredible potential of teams," says Aucoin, author of *From Engineer to Manager: Mastering the Transition* (Artech House Inc., 2002), a book geared to the engineer promoted to manage a technical team. According to Aucoin, three ingredients go into building a successful team: having a common mission or purpose, being determined to accomplish the mission, and refusing to be restrained by limitations.

Setting up a group exercise can accelerate the process of team building and illustrate the value of those three ingredients, Aucoin says. Shared experiences, especially those that involve challenges and adversity, lead team members to trust and gain confidence in each other.

"Exercises can range from white-water rafting trips to improvising music with percussion instruments," he says. Such group activities can channel a collection of individuals into functioning as a team; genuine, useful teamwork, however, only comes under fire on the job.

One thing team members learn while sharing experiences is communication. How can engineers turned managers communicate more effectively? To begin with, managers should listen more, Aucoin says.

"A manager must become skilled in listening and understanding, as well as in delivering messages clearly," he says. Listening to subordinates is critically important. Studies show that more than 60 percent of employees say their supervisors aren't interested in their work or don't care about them as people, Aucoin says, adding, "You must guard against giving such impressions."

The basic nature of a manager's communications is also apt to change once that promotion comes. "As an engineer, you likely focused on technical communications," Aucoin says. "But as a manager, your primary communications may shift from technical to business information. Your audience may also change from technical personnel to individuals of varied backgrounds. Your communication content and style should change accordingly."

Newly minted managers might want to join the IEEE Engineering Management Society (http://www.ewh.ieee.org/soc/ems) or the IEEE Professional Communication Society (http://www.ieeepcs.org). The EMS can help you keep abreast of management tools and techniques. The PCS helps engineers and other technically oriented professionals communicate better.

Internet Conferencing

The Next Best Thing to Being There

BY KATHY KOWALENKO

WHEN Dmitry Tkachenko couldn't travel to Washington, D.C., for his society's administrative committee conference, he joined in from St. Petersburg, Russia. And when Celia Desmond had to give a 90-minute technical talk to about 15 IEEE members spread out over Asia, Europe, Latin America, and North America, she did it from her office near Toronto.

IEEE meeting organizers are increasingly replacing in-person, face-to-face sessions with meetings held over the Internet. They do it with the IEEE Internet Conferencing service, which allows any number of people from anywhere in the world to meet and transact business. Since the service was introduced nearly five years ago, more than 700 IEEE meetings have been held online.

Both Tkachenko and Desmond tapped the IEEE's conferencing service, relying on such recently added features as voice over Internet protocol (VoIP) for listening to speakers and participating in online chats. They each report having good experiences: pictures were clear, voices crisp, cost minimal, and travel time zero.

Recent upgrades to Microsoft Corp.'s Live Meeting software make the IEEE conferencing environment easier and more efficient to use than other online conference programs, says Lenore Johnson, a Web analyst with IEEE Technical Activities in Piscataway, N.J., which oversees the service. With the new VoIP feature, meeting participants need only a computer with a sound card, speakers, and an Internet connection to see and hear everything. VoIP streams the audio across the Internet and through the speakers, eliminating the need for a telephone. And with the ability to key in questions to the presenters in a chatlike session, audience members can get answers in real time.

Meetings with verbal give-and-take, such as brainstorming sessions, can't rely on instant messages; attendees require telephones so participants can speak to each other.

Desmond, a senior member and past president of the IEEE Communications Society, gave her talk on the trends in telecommunications from her office at World Class Telecommunications in Mississauga, Ont., Canada, where she serves as president.

"Voice-over-IP quality is pretty good, and there's no reason to hold back on using the conferencing service other than unfamiliarity with how it works," she says.

First-time users can take online instructor-led training that explains the Internet Conferencing Web site and how it works. The conference software is a Microsoft product, and navigation relies on familiar menu-driven commands and icons, Johnson points out. Charts, graphs, and diagrams can be created with such programs as Acrobat, Excel, PowerPoint, Visio, and Word.

Johnson also notes that the upgraded software allows presenters using a telephone more control of their meetings. For example, they can mute participants' phone lines to eliminate background noise. And they can "lock" the meeting so latecomers cannot disturb a speaker.

Because it eliminates teleconference connection fees, the VoIP feature will attract more users to the service, Desmond says. Before VoIP, participants in the United States had to dial a toll-free phone number to hear what was being said and to communicate verbally. Those in other countries typically dialed into a teleconference bridge set up for the meeting. For meetings that still require telephone connections, fees are reasonable, averaging about US 10 cents a minute per connection, depending on requirements, Johnson says.

GREETINGS FROM RUSSIA Tkachenko, a senior member and a member of the IEEE Broadcast Technology Society's administrative committee, attended his committee's meeting on 31 March and 1 April. Because of the eight-hour time difference between Washington and St. Petersburg, he joined some of the sessions via a broadband Internet connection from his office and some through a dial-up connection from his home. His computer has no speakers, so rather than VoIP, he used the service's chat feature to participate in discussions on finances, membership growth, and new publications.

He also couldn't link in by telephone, because he needed the line to dial up the Internet. He followed along by reading transcripts of the audio portions being fed to him as a chat conversation by a meeting administrator who was sitting in on the sessions.

Tkachenko says connecting was easy both from his home and his office at the St. Petersburg State Polytechnic University, where he is an associate professor in the radio engineering and telecommunications department. He also used the question-and-answer feature to send queries to the speaker and the chat feature to discuss a point with other participants.

"Attending the meeting this way was very effective," he says. "Of course, it cannot substitute for personal participation, but it gives people an opportunity to attend in real time, which may be sufficient for participants who are not key speakers."

Tkachenko also encourages IEEE societies to use the service for meetings with attendees whose native language is not English. "For those who read English more fluently than they speak it, combining transcripts with slides is more informative than a telephone conference alone," he says.

LET'S MEET Organizing your meeting starts with a visit to the IEEE Internet Conferencing service at http://www.ieee.org/portal/pages/web/webconf. Once you've logged on, you fill out a registration form with details such as the meeting's date, start time, and number of people expected to attend. An IEEE staff member is assigned as your meeting administrator, and that person helps you set up your conference. One of the first tasks is to assign you a Web address known as a Conference Center. Before the meeting, you upload any visual materials to that address.

Participants receive a meeting invitation from the conference organizer, with access information for the Conference Center so they can view the meeting visuals from their Web browsers and hear the presentations at their locations. They also can use the service's various options—such as sending questions to a presenter like Tkachenko did or asking a speaker to slow down.

The fee for the Internet Conferencing service is $75, and its use is restricted to members conducting IEEE business meetings.

FOR MORE INFORMATION Visit http://www.ieee.org/portal/pages/web/webconf or e-mail web-conf@ieee.org.

MEMBER RECOGNITION

Dresselhaus Garners $250 000 Heinz Award

BY LINDSAY ELKINS

LIFE FELLOW MILDRED DRESSELHAUS has been recognized by the Heinz Family Foundation of Pittsburgh for teaching engineering students the ins and outs of industry, as well as for her efforts to help women succeed in the sciences.

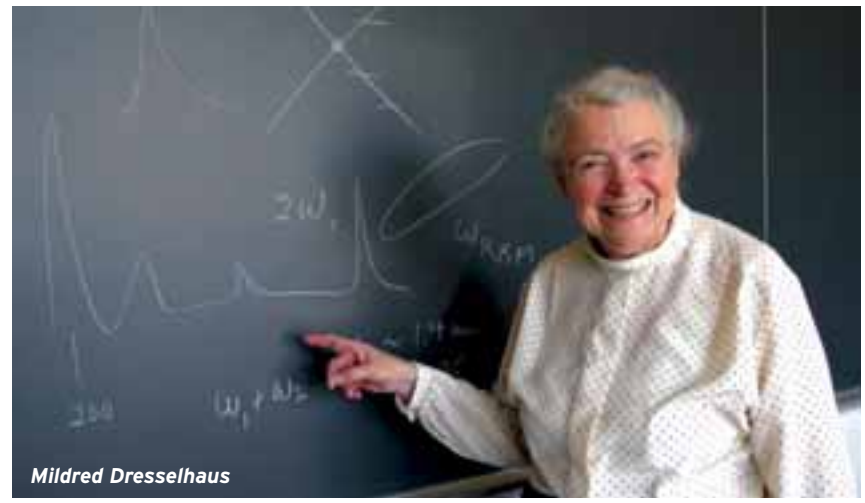
This year's Heinz Award was presented in May to Dresselhaus and five others. The award, named for the late U.S. Senator John Heinz, recognizes leaders in several fields including public policy, the environment, and the arts and humanities. Dresselhaus was cited for her efforts to expand scientific opportunities for women and her contributions in the fields of carbon science—which includes nanotechnology—and thermoelectrics, the conversion between electrical energy and thermal energy. Award recipients receive a cash prize of US $250 000.

Dresselhaus arrived at the Massachusetts Institute of Technology, in Cambridge, in the 1960s as a researcher looking into superconductivity. She noticed that women tended to shy away from engineering. Yet their reticence had nothing to do with their skills. "When I came to MIT, women were having a hard time joining study and lab groups," she says. "Many dropped out because it was not a welcoming environment."

Dresselhaus wanted women and minority students to believe they could succeed in a science field. So she designed a course called What is Engineering? at which MIT science and engineering faculty members would speak about their struggles starting out and how they overcame those obstacles.

"Hearing people talk about their difficulties gave students the courage to believe that they could succeed as well," she says.

PROPER FOCUS In the early 1970s, Dresselhaus noticed that female faculty members had trouble getting promotions because they failed to focus on things that would help them move up the career ladder, such as getting grant money for research. So Dresselhaus held luncheons a few times a year where women could discuss how to write grant proposals, what the promotion system was about, and how to care for a family while managing a career. "After a few years of these luncheons, women were getting tenure at the same rate as men," she notes.



Mildred Dresselhaus

Dresselhaus is passionate about helping women thrive in a scientific field because she can relate to their challenges. She struggled to balance her career and family while working in the research department at Lincoln Labs in Lexington, Mass. She started there in 1964 with a master's degree from Radcliffe College, also in Cambridge.

The lab required all employees to begin work at 8 a.m. With four young children, Dresselhaus found the schedule difficult. Some friends saw Dresselhaus struggle and nominated her for a teaching fellowship at MIT, where she would have the flexibility she needed. Dresselhaus became a visiting professor in 1967 and later was hired as a permanent faculty member.

She has for many years been working on nanoscience with her MIT students. Nanotechnology hasn't entered the commercial market in any significant way yet, but it is starting to pick up speed. For example, it is being used by the lighting industry in light-emitting diodes, she says.

IN MEMORIAM

Jack St. Clair Kilby Technology Titan

BY TOM ENGIBOUS

JACK ST. CLAIR KILBY was an engineer and proud of it.

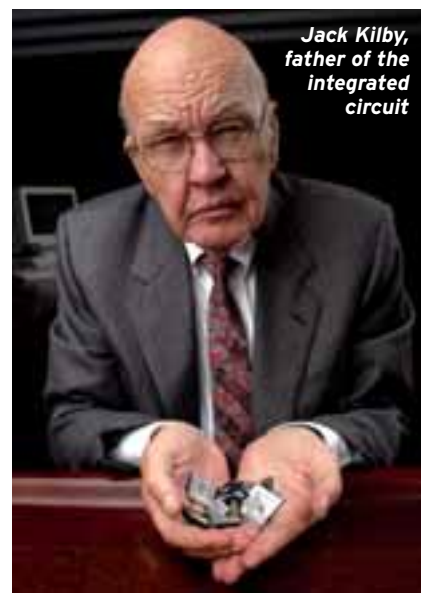
He was a gentleman and a gentle man. He was practical and low-key. He was generous, thoughtful, good-humored, and humble. Yet despite his quiet ways, IEEE Fellow Jack Kilby's legacy is the modern world we know today. His invention of the monolithic integrated circuit in 1958 laid the foundation for today's world of microelectronics, and in 2000 he was awarded the Nobel Prize in Physics for this work.

Reared in Great Bend, Kan., he discovered a passion for engineering in high school. After an ice storm downed phone and power lines, his father, who ran a small power company, worked with amateur radio operators to communicate with customers. This triggered young Kilby's lifelong fascination with electronics.

In 1950 he joined Centralab, in Milwaukee, where he worked with transistors.

In an age when soldering irons were used to connect components, the industry needed a better way to build electronics. In 1958, he left Centralab and moved to Dallas to work on this issue for Texas Instruments. As a new employee that summer, he was not eligible for the August vacation that was customary among TI employees at the time. In this relatively quiet time, the idea of the integrated circuit first came to Jack. In a July 1976 IEEE paper entitled "Invention of the Integrated Circuit," Jack wrote, "I began to feel that the only thing a semiconductor house could make in a cost-effective way was a semiconductor. Further thought led me to the conclusion that semiconductors were all that were really required—that resistors and capacitors, in particular, could be made from the same material as the active devices." Jack integrated all the devices on one substrate.

The circuit was put to the test on 12 September 1958. It worked—an elegant solution for the increasingly complex electronic designs of the time. But many in the industry were skeptical. Some said integrated circuits did not make optimal use of materials, while others said such chips were not commercially viable.



Jack Kilby, father of the integrated circuit

Looking back on those days, Jack said, "We were the source of entertainment at IEEE conferences over the next few years."

But then as now, change is the nature of this industry. The integrated circuit was commercialized, and today its applications touch every facet of our lives.

Tom Engibous is the chairman of Texas Instruments Inc., Dallas.

JACK ST. CLAIR KILBY 81
DIED 20 June 2005
MEMBER GRADE Fellow
EDUCATION Bachelor's degree in electrical engineering from the University of Illinois, Chicago, 1947; master's degree in electrical engineering from the University of Wisconsin, Milwaukee, 1950
FIELDS OF INTEREST Electronic component miniaturization, integrated circuits, silicon technology
VOLUNTEER ACTIVITIES Member of the Electron Devices Society; member of the Components, Packaging, and Manufacturing Society
AWARDS 1966 IEEE David Sarnoff Award; 1969 National Medal of Science; 1978 IEEE Cledo Brunetti Award; 1984 IEEE Centennial Medal; 1986 IEEE Medal of Honor; 1990 National Medal of Technology; 1999 Vladimir Karapetoff Award; 2000 Nobel Prize in Physics

Editor's note: The IEEE Jack S. Kilby Signal Processing Medal was established by the Board of Directors in 1995 "for outstanding achievements in signal processing."

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