IEEE

IEEE MEMBER HELPS ROVERS EXPLORE THE RED PLANET P. 6

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Saving Lives, One Land Mine at a Time

IEEE members work to develop new sensors that detect metal and plastic mines

BY KATHY KOWALENKO

IEEE MEMBERS ARE answering the call to rid the world of land mines. They are working to develop sensors that will detect the mines quickly, accurately, and safely.

Some might consider it an impossible task. More than 100 million land mines are buried in over 80 countries around the world, according to the International Campaign to Ban Land Mines, headquartered in Washington, D.C. It estimates that removing them at the present rate will take more than 500 years and US$33 billion. Mines kill or injure an average of 70 people every day.

"I get a good feeling knowing that I am helping to foster technology that will clear an area of these destructive devices," says IEEE Fellow James Keller, a professor of electrical and computer engineering at the University of Missouri-Columbia, USA. In addition to developing sensing systems, Keller and others are working on the data processing systems that are also needed for detecting mines.

Considering the amount of research carried out on detection systems, finding buried land mines is still incredibly difficult. Most are encased in plastic, not metal, and there is no such thing as a reliable plastics detector—yet.

LAND MINE BASICS Mines can be square, round, cylindrical, or bar-shaped. Most are antipersonnel mines, while some are anti-tank mines, meant [Continued on page 10]

IEEE Fellow Larry Carin [right] holds a prototype of a hand-held land-mine detector outfitted with ground penetrating radar. Another researcher views signals on a laptop, returned from a metal mine [foreground].

Business 101 For Engineering Entrepreneurs

BY ERICA VONDERHEID

DO YOU THINK YOU HAVE what it takes to run your own engineering business? Some IEEE members took time from their busy schedules to tell us their reasons for going out on their own and of their adventures in entrepreneurship.

"I got tired of living by other people's rules," says Dan Berube, a member who runs BeruGold Research Corp., an engineering contracting business, specializing in electronic warfare and intelligence applications, from Manasquan, N.J., USA. "There was no opportunity for any creativity by working for a big corporation."

To keep overhead low, many engineering entrepre- [Continued on page 12]

Dan Berube

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IEEE INFORMATION DRIVING INNOVATION

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NEWS

FROM AROUND THE IEEE & THE WORLD

Amending the IEEE's Constitution

THE BOARD OF DIRECTORS has initiated several revisions to the IEEE Constitution based on requests from the IEEE leadership and several major boards. One revision will clarify the constitution's language regarding the organization's procedure for electing corporate officers, such as the President of IEEE–USA and the Vice President of Technical Activities.

For example, because the Technical Activities Board oversees the IEEE societies, only the members of societies—instead of the entire voting membership—vote for the Technical Activities Vice President.

In addition, the Board proposes to modernize the constitution's language and to delete requirements that no longer make sense in a global organization or are no longer required by law. It also proposes to remove a conflict between *Robert's Rules of Order* and the IEEE process governing the IEEE President's voting rights when chairing a meeting.

The Board asks members to vote yes on a proposed amendment containing the constitutional revisions, which will be on the annual election ballot arriving in September.

To adopt an amendment requires an affirmative vote of at least two-thirds of all ballots cast, provided the total number of those voting is not less than 10 percent of all the IEEE's voting members.

More details on the revisions will be on the IEEE Web site by 15 March.

IEEE Policy 13.8 outlines the procedure on how to oppose proposed revisions: visit http://www.ieee.org/about/whatis/policies.

Candidates for 2005 President-Elect

Three candidates will be on the 2004 election ballot to succeed W. Cleon Anderson as President in 2006.

MICHAEL LIGHTNER, Fellow Lightner is a professor of electrical and computer engineering and computer science at the University of Colorado, Boulder, USA. He is the IEEE Vice President of Publication Services & Products and serves on the IEEE Board of Directors. He became an IEEE Fellow for contributions to the computer-aided design of integrated circuits.

LEVENT ONURAL, Senior Member Onural is a professor in the electrical and electronics engineering department at Bilkent University, Ankara, Turkey, where he is involved in all aspects of the department, including curriculum development, student affairs, and rules and regulations. He is associate editor of *IEEE Transactions on Circuits and Systems for Video Technology.* He also has held several positions with the IEEE, including Region 8 Director and member of the IEEE Assembly.

JAMES M. TIEN, Fellow Tien is Vice President of Educational Activities at the IEEE and a member of the IEEE Board of Directors. He is professor and chairman of the department of decision sciences and engineering systems at Rensselaer Polytechnic Institute, Troy, N.Y., USA. Tien is a member of the U.S. National Academy of Engineering and was made an IEEE Fellow for contributions to systems engineering as applied to public systems.

Millionth IEEE Document Goes Online

IEEE XPLORE, the document delivery system for all IEEE technical papers, articles, and standards, placed its one-millionth document online in January. The article, "Novel Frame Buffer Pixel Circuits for Liquid-Crystal-on-Silicon Microdisplays," was originally published in the January 2004 issue of *IEEE Journal of Solid-State Circuits.*

"This milestone illustrates the IEEE's importance as the primary source for current technical literature," says Anthony Durniak, IEEE Publications Staff Executive.

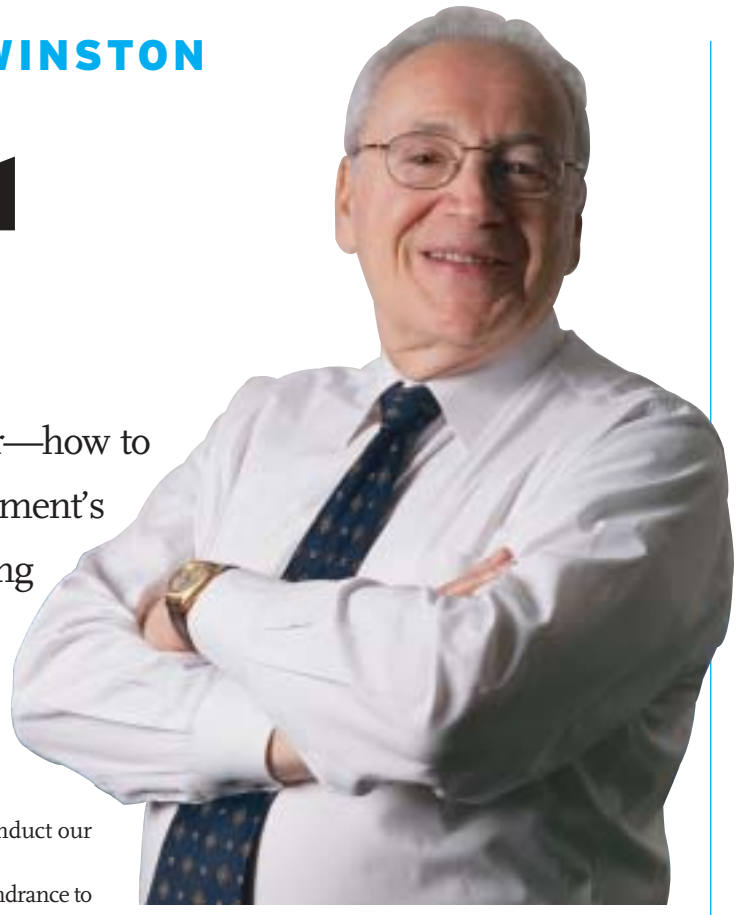
The IEEE online collection of technology articles and papers has grown by more than 25 percent over the last 18 months, and now includes more than 80 000 documents originally published between 1950 and 1987.

Former NEC Chair Receives IEEE Medal of Honor

TADAHIRO SEKIMOTO, former chair of NEC Corp., Tokyo, is the recipient of the 2004 IEEE Medal of Honor. An IEEE Life Fellow, Sekimoto is being recognized for his remarkable career of contributions to the field of digital satellite communications, his promotion of information technology research and development, and technical and corporate leadership in computers and communications. He is also credited with turning NEC into a global giant that excels in a wide spectrum of technology.

The Medal of Honor, sponsored by the IEEE Foundation, is the IEEE's highest award. It will be presented to Sekimoto at the annual IEEE Honors Ceremony in June in Kansas City, Mo., USA.

Technology Reaches Beyond Borders—and So Do We



ONE OF THE TOUGHEST ISSUES the IEEE confronted last year—how to serve members in countries embargoed by the U.S. Treasury Department's Office of Foreign Assets Control (OFAC)—has revived a long-running debate among many members. Stated simply, these members are asking whether the IEEE is a global organization or a U.S. organization with members from around the world.

There are no easy answers to this question, and I don't intend to offer a solution here. However, the IEEE founders intended the organization to be international in scope. In *Engineers and Electrons: A Century of Electrical Progress* (IEEE Press, 1984), coauthors John Ryder and Donald Fink state that the engineering leaders who united our two predecessor societies in 1963 to form today's IEEE believed the name of the new organization should exclude "American." Indeed, Ryder and Fink added, "The proposed Institute would be transnational in character, serving electrical engineers around the world."

I believe the IEEE has remained true to our founders' vision—a global organization that encourages engineers and other technical professionals to exchange ideas and participate in scholarly activities. Almost 38 percent of the IEEE's more than 360 000 members are citizens of countries other than the United States, and for some years our non-U.S. regions have been the fastest-growing area of membership.

Two factors may fuel the perception of the IEEE as a U.S. organization. First, while we are a global association serving members in more than 150 countries, we are headquartered in the United States, and we conduct our business according to its laws.

Historically, U.S. laws have posed minimal hindrance to how the IEEE has served our worldwide membership. While the current embargoes, which impose barriers on what members in embargoed countries may publish in IEEE publications, our organization is committed to overcoming these obstacles. Last September, the IEEE won an unprecedented decision from OFAC that exempts the IEEE's publication processes for articles submitted by members in Iran. We are working to resolve other OFAC issues, and we hope to achieve additional positive results this year.

The other reason for the perception of the IEEE as anything but a global organization is IEEE–USA's confusing name and its perceived status in relation to our other organizational units. While many of IEEE–USA's activities—notably intellectual property and career strategies—help to positively influence our global membership, other actions create internal friction and external mix-ups. For example, members are asking the IEEE's leadership to improve relationships with companies worldwide, but IEEE–USA's position to reduce the number of visas that permit technical personnel who are not U.S. citizens to work in the United States, combined with the similarity of the names "IEEE" and "IEEE–USA," negatively affect our efforts to forge stronger relationships with industry.

Despite these issues, the IEEE will continue working to provide services and maintain the interests of our worldwide constituency. Technology, communications, and economic factors in our dynamic world demand that we must be global. After all, technology is global.

In his book, *Fortune Favors the Bold* (HarperBusiness, 2003), Lester Thurow says that we must boldly embrace globalization if we are to assure prosperity. The Massachusetts Institute of Technology economist advises developed nations to build economic systems that minimize instability in other countries and allow developing nations to thrive.

I don't pretend to have the answers, but problem resolution begins with healthy discussion. I welcome your comments at president@ieee.org.

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Living on Martian Time

BY ERICA VONDERHEID

MEMBER ALBERT HALDEMANN is living like a Martian. He goes to work on Mars every day, he lives by Mars time, and the license plate on his car reads "MARS ROX."

Haldemann is the deputy project scientist for NASA's Spirit and Opportunity vehicles, the rovers that landed on Mars in January. Once the rovers touched down, Haldemann began working on Martian time to coincide with the rovers' sleep and work cycles. The Martian day is 24 hours and 39 minutes long, which means that his work cycle shifts by 39 minutes every day.

"I've been a space nut since I was a kid reading science fiction and watching 'Star Trek,' " Haldemann says. "My interest in Mars jelled when I saw the images sent back from the Viking landing on Mars in 1976."

He describes his job at the Jet Propulsion Laboratory in Pasadena, Calif., USA, as similar to that of a customer service representative in a traditional engineering firm. He makes sure that the JPL engineers who build the rovers have the right information about the Martian environment for design and planning purposes. He makes sure that the scientists working with the data—mostly academics working at universities around the country, not at JPL—understand the hardware constraints. And he and his colleagues must also be aware of how an engineering decision might affect the scientific information being transmitted back to Earth.

IEEE Member Albert Haldemann, deputy project scientist for NASA's Mars Exploration Rover Project, keeps his eye on the quality of data sent by rovers Spirit [in artist's rendering] and Opportunity.

Haldemann's eye is always on the data. "The project scientist is there to make sure the science returned to Earth meets the objectives that were laid out," he says.

He got involved in the Mars Exploration Rover project in October 2000, shortly after NASA asked JPL to take the two rovers on. Spirit and Opportunity were sent to gather data from Martian rocks to try to determine if Mars's past climate could have sustained life.

REACHING FOR THE STARS Born in Bern, Switzerland, Haldemann moved with his family in 1970 to Toronto, where he grew up and attended high school. He returned to Switzerland in 1984, however, to attend the Université de Neuchâtel, and he also served in the Swiss Air Force as a jet pilot.

After earning a bachelor's degree in particle physics, Haldemann attended the California Institute of Technology (Caltech) in Pasadena, USA, to pursue a Ph.D. in planetary science. For part of his thesis, he used radar remote sensing to evaluate possible landing sites for NASA's Mars Pathfinder rover that landed in 1997. With radar remote sensing, Haldemann and his colleagues can get a preliminary idea of what the surface of Mars looks like. This work got him a postdoctoral position on the Pathfinder team, which turned into a staff position within JPL's planetary radar group.

On the Pathfinder mission, Haldemann worked on soil mechanics as well as geomorphology—a fancy way of saying he counted the rocks, more than 4000 of them, in the images the rover sent back.

Spirit touched down in the Gusev crater, a dry lake bed near the Martian equator, on 5 January, and Opportunity landed in the Meridiani Planum, where mineral deposits might indicate the presence of water, on 25 January. The spacecraft traveled the more than 450 million kilometers to Mars in seven months.

Haldemann was not in the control room at JPL when Spirit and Opportunity landed. Because more than 1000 engineers, scientists, and support staff are involved in the project, JPL set up a large auditorium on the nearby Caltech campus for them to view the images from Mars. The auditorium had a direct feed from the JPL control room, and Haldemann served as the master of ceremonies during both landings. He provided commentary on the images and cheered along with everyone else, including his wife and two daughters.

Haldemann says his reaction when seeing some of the first images that Spirit sent back to Earth was, "Hey, the radar works. I got it right." Radar signals from Earth played a role in choosing the landing site on Mars.

"It's a small contribution that I share with a small group of people in planetary radar at JPL," Haldemann says.

Haldemann and other engineers had cause to be pleasantly surprised that it all worked, at least at first. Most attempts to land on the Red Planet in the last decade have failed. And just two weeks before Spirit touched down, a British-built rover called Beagle II tried to land. But by late January, Beagle II still had not been heard from.

After Spirit sent some pictures and data back to Earth, it too had problems. Its transmissions stopped. JPL engineers and scientists diagnosed the problem, which appeared to relate to the flight software and memory systems that caused the rover's computers to reboot several times a day.

BACK TO HEALTH At press time, engineers had erased and reformatted Spirit's flash memory system and they expected the problems to be fixed. "We have plenty of reason to be optimistic, and we're looking forward to having a healthy Spirit rover," Haldemann says.

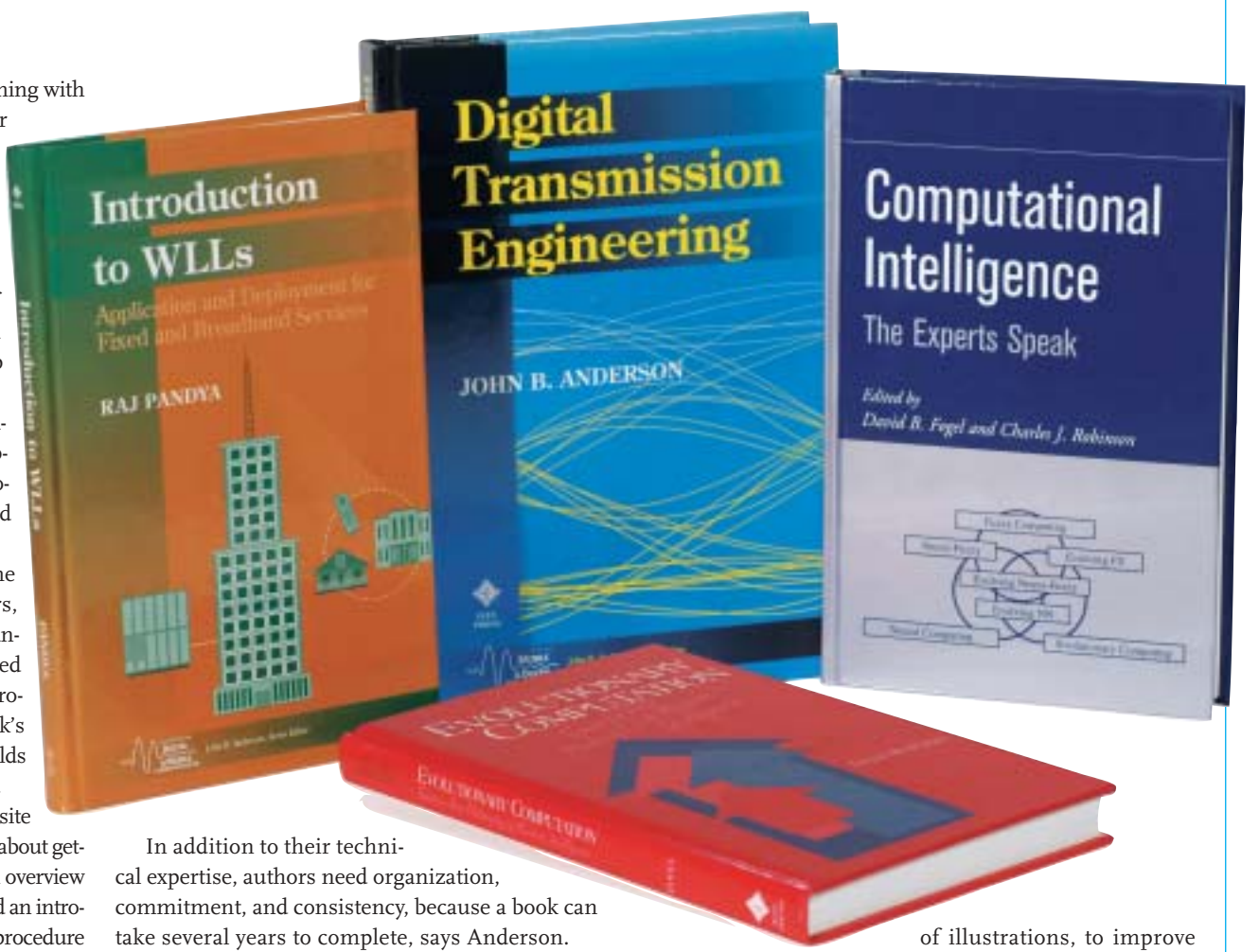
For Haldemann the strange hours and hard work have been worthwhile.

"The big payoff is the exploration, seeing new vistas, being able to influence how that information is acquired, and being right there when that information is returned," he says. "It's a big mission and it generates big science."

For more information about the Mars rovers, visit http://marsrovers.jpl.nasa.gov/home.

Turning Experts Into Authors

BY CAROL GOODALE



IEEE FELLOW DAVID FOGEL says that publishing with the IEEE Press offers special benefits. The editor of the new IEEE Press Series on Computational Intelligence adds that this series, as well as others published by the IEEE, "brings cutting-edge research to a large cross section of people who are in the best position to move the research into real-world applications." And if you're unsure of yourself as a writer or of the process for getting a book published, IEEE Press staffers will help teach you what you need to know, says Fogel.

With its focus on electrical and electronics engineering and computer science, IEEE Press publishes a broad range of authored and edited monographs, as well as handbooks, textbooks, and reprints of collected papers.

Authors come from the entire range of the engineering professions, including educators, researchers, manufacturers, consultants, and managers. Most IEEE Press authors have published technical papers, while others have conducted professional seminars or short courses on their book's topic. But all IEEE authors are experts in their fields with a commitment to sharing their knowledge.

The Authors Pages at the IEEE Press Web site offer prospective writers step-by-step information about getting published, including proposal guidelines, an overview on the book-development and writing process, and an introduction to book production and publishing, a procedure the Web site terms "sometimes mysterious and confusing for the uninitiated." But helping the uninitiated become published authors is what the IEEE Press does well.

START WITH A PROPOSAL The first step for a prospective author is to submit a proposal to explain what the book will be about and how it will be organized, including a detailed table of contents and information about why the book is needed and who will want to buy it. IEEE Press staff as well as external reviewers evaluate the proposal and provide feedback to the author on both the technical merit and market potential of the proposed book. The initial process, from submitting a proposal to negotiating and signing a book contract can take about two to three months, though the time varies with each project.

Once a contract is signed, the writing and development process gets into gear. Portions of the manuscript may be reviewed as it moves along to provide the author with useful feedback during the writing process. The technical review process is a critical part of producing a quality book and the IEEE Press offers authors a large base of reviewers who are experts in their fields.

REVIEWS BY EXPERTS New authors may be hesitant about having experts review their manuscripts, says author John Anderson, professor of digital communications at Lund University in Sweden and editor of the IEEE Press Series on Digital and Mobile Communication. "But the more you write, the more you realize you want to find out the weak spots sooner rather than later."

In addition to their technical expertise, authors need organization, commitment, and consistency, because a book can take several years to complete, says Anderson.

"You have to know how to maintain the effort," Anderson explains. "You also have to consider how to organize information and how people absorb words."

An IEEE Press staff editor works with each author. While the author is the expert on the book's content, the editor is the expert in marketing IEEE Press books, and may suggest ways, such as changing length and number of illustrations, to improve marketability and profitability of a book.

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For the IEEE Press, which has published more than 400 books for the engineering community, successful books are not the ones that generate the most money. They are the ones that receive professional recognition as the definitive works in their subject areas, and contribute to the advancement of electrical engineering knowledge.

To help focus its editorial acquisition activities as well as to attract authors, the IEEE Press staff and IEEE volunteers collaborate on determining topics in electrotechnology. "We like to work with IEEE Societies to develop our target list of hot topics and new titles," says Cathy Faduska, senior acquisitions editor of IEEE Press. [See "The 10 Hottest Technical Topics," left.] New topic suggestions are welcome and the list is not intended to be exclusionary, she notes.

Online information and guidelines for prospective authors can be found at http://www.ieee.org/organizations/pubs/press/AuthorsPages.htm.

The 10 Hottest Technical Topics

BASED ON INPUT FROM THE IEEE SOCIETIES and IEEE members, the IEEE Press is seeking authors for books in these 10 cutting-edge areas:

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Nanotechnology
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Optical networks
Security applications
Solid-state lighting
Storage area networks

If you have an idea for a book on these or any other topic, contact Cathy Faduska at c.faduska@ieee.org.

Standards Hidden

BY ERICA VONDERHEID

IEEE Standards can be found behind technologies we use every day at home, at work, and at play

They're responsible for the way your computer works, as well as for your television set, wireless router, video games, and many other electronic products. Most people don't even know they exist.

These products all depend on IEEE technical standards, which establish guidelines for how things are designed and the specifications they should meet. IEEE Standard 802.11, which also goes by the popular name of Wi-Fi, is one standard the public does know about, thanks to the wireless products and publicity it fostered. An amendment to the standard released last June boosts the speed of wireless local-area networks to 54 megabits per second from 11 Mb/s.

A standard is a document produced by a committee of experts in a particular technical field that specifies how a product should be designed, provides a common set of definitions, or sets up safety regulations. Manufacturers, researchers, and public utilities use the guidelines in these documents, for example, to design systems that make electric power clean and reliable, electronic devices easier to use, or research data simpler to share. Having a common terminology is crucial.

"The IEEE has a long history of creating technical standards that help engineers understand what other engineers are talking about," says Edward Rashba, manager of new technology projects for the IEEE Standards Association (IEEE–SA). The IEEE—through its predecessor society, the American Institute of Electrical Engineers—has been involved in standards since 1892.

"The ideal standard disappears because it solves a problem that was causing frustration," says Jim Isaak, the chair of the working group that developed IEEE Standard 2001 for Web site reliability.

For example, consider that many of us take for granted that the cable from a printer purchased two years ago will work on a new model from a different manufacturer. That interoperability is possible thanks to IEEE Standard 1324. Similarly, because of standards, it's possible for a 100-watt incandescent light bulb to fit the socket of all table lamps and for a Beatles CD to play in the console in your living room, in your car, or in a portable CD player.

An individual standard is developed in an IEEE working group by experts in the area covered. These volunteer experts are typically compensated for the time and expenses incurred in this endeavor by their companies or organizations. Currently, more than 11 000 participants in 95 countries support the IEEE standards development effort.

Whether companies in an industry adopt an IEEE standard is voluntary. But selling a product may be next to impossible if it cannot operate with other products that do adhere to the standard.

The IEEE Standards Association has published about 900 standards that are now in use, and some 400 more are currently being developed. Every year the association releases about 100 new standards. Here are a few standards that affect devices you might come across in your daily routine.

GOOD MORNING: 6 A.M.—Your clock radio signals the start of a new day, even though many other homes in your town lost power in the middle of the night. Your subdivision uses a small generator that runs on diesel fuel and supplies power when the grid in your area goes down. IEEE Standard 1547 outlines the requirements for running distributed generators when power is out. Also thanks to the standard, when the power grid is up and working, distributed energy sources like your generator can supply excess power back to the grid.

This capability broke new ground. "The electric power system as we know it—ever since Thomas Edison—is a radial grid where power flows out from the central generating station to users, not backward," says Richard DeBlasio, chair of the IEEE 1547 Working Group. "IEEE Standard 1547 allows the grid to operate in both directions, and one of them is, in effect, backward."

GLIDING DOWN THE FREEWAY: 8:30 A.M.—An early-morning accident and fuel spill on the highway during your morning commute brings rush-hour traffic to a crawl. But thanks to IEEE Standard 1512, the local police and fire departments and emergency medical services arrive at the scene to get people and vehicles off the road fast and get you to work on time.

The standard sets up guidelines allowing each emergency responder to communicate with the others. Also, the standard outlines a common set of data fields to communicate details of the accident uniformly, ensuring that the right people and equipment arrive on the scene.

AT WORK: 9 A.M.—At the office, you need to share documents over a network with colleagues. If your company uses a wireless local-area network that conforms to IEEE Standard 802.11g, you can share those documents four times faster than you could a few years ago. This standard—an amendment to 802.11—transmits data up to 54 Mb/s, up from the 11 Mb/s called for in 802.11b. Another standard, 802.11a, operates in the 5-gigahertz band rather than in the lower 2.4-GHz band where there can be interference from devices such as cordless telephones and microwave ovens.

Then, while doing research on the Internet for a project in the office, you need to know if the information on a Web site is

in Plain Sight

from a credible source. If the site conforms to IEEE Standard 2001, developed in collaboration with Consumers Union and only released in 2002, there should be some reassuring information there. For example, every page would have a link that names the organization supplying the information, how to contact it, and a statement that your privacy will be protected. Expiration dates on the pages ensure that the information presented is current. The standard also has guidelines for creating Web sites that people with disabilities can use. Isaak says he's had discussions with Google and the European Union about adopting the standard.

TEARING UP THE AIRWAVES: 2:30 P.M.—Between client meetings, you stop at a coffee shop with wireless networking capability—also known as a hotspot—and use your laptop to log onto your company's e-mail system. Thanks to IEEE Standard 802.11, you and your fellow caffeinated road warriors can use the same wireless connection at speeds up to 54 Mb/s.

If the battery in your laptop complies with the proposed IEEE Standard 1625, your laptop has a better chance of having enough power for you to reply to all those urgent e-mails from the office. The standard also specifies ways to make batteries more reliable, notes Jeff Layton, chair of the IEEE 1625 Working Group.

IN SICKNESS AND IN HEALTH: 5:30 P.M.—On your way home from work, you stop at the cardiologist's office for an electrocardiogram (EKG). If the EKG, like other medical electronic equipment, meets IEEE Standard

1073, a nurse can plug the EKG device into a network—no complex configuration or programming required—and the data are captured, processed, and archived in the hospital's computer system without extra software, additional hardware, or loss of information. The guidelines in the standard make all this possible.

Adhering to the guidelines will also cut errors in transferring information. Medical personnel will no longer need to manually record readings produced by several different kinds of diagnostic equipment into a patient's chart. The chart is also on the computer system, points out Todd Cooper, chair of the IEEE Standard 1073 Working Group, and readings would go into it automatically.

PLAYTIME: 7 P.M.—Spend some quality time with the kids by enjoying a video game without wires snaking across the living room. IEEE Standard 802.15.4 provides a common framework for small, low-data-rate wireless devices, such as video-game controllers, to connect to a game-playing console at 10 to 250 kilobits per second at distances of 10 meters or less.

MUSIC, MUSIC, MUSIC: 8 P.M.—Take your special someone to a concert. A performance that uses equipment conforming to IEEE Standard 1639, currently under development, can connect musical instruments, special effects equipment, and lights to a personal computer over Ethernet-based networks or IEEE Standard 802.11 wireless devices.

The new standard updates the 20-year-old musical instrument digital interface—or MIDI—standard and boosts the data rate among musical instruments and equipment to 10 gigabits a second. It also increases the potential number of devices that can be connected on a port from the old 16 to, theoretically at least, close to 16 million.

"The amount of data that can be transmitted is fantastically greater, plus you have the freedom of movement and expression if you go wireless," says Phil Kerr, chair of the 1639 Working Group.

LATE-NIGHT RECORDING: 11 P.M.—Before turning in, you set your digital video recorder on top of your television to record a program broadcast in the middle of the night. Using a network connection that conforms to IEEE Standard 1394, you can either save that program digitally with a device like TiVo on an external hard drive or transfer it to your personal computer to watch at a more convenient time.

"IEEE Standard 1394 is gaining momentum for a digital video interconnect in the home," says Peter Johansson, chair of the IEEE Standard 1394 Working Group. ●

FOR MORE INFORMATION on IEEE Standards, visit http://standards.ieee.org.

LANDMINE DETECTION from page 1

The antipersonnel mine [above] was found in Bosnia by mine-clearing experts.

An Afghan soldier [right] swings a metal detector over the ground in Kabul in search of land mines. Afghanistan is one of the most heavily mined countries in the world and the land mines left over from its 23 years of war kill or injure 50-75 people a month.

to destroy vehicles. They are wrapped in metal, the more difficult to detect plastic, or even wood. Antitank mines are buried as deep as 40 cm, while antipersonnel mines are buried just beneath the surface.

Detection and removal is slow and tedious. The design of the mine detector currently in use, which is sensitive to metal, dates back to World War II, though today it has more sensitive sensors.

A crew divides a search area into lanes of about a meter wide. They carefully clear any thick vegetation from the ground just ahead. Another crew member swings a hand-held mine detector over the cleared ground from one side of the lane to the other. If nothing is detected, the crew moves forward a step at a time. The key to survival is not to step before you swing.

If the detector comes across metal, it sends signals through headphones worn by the operator. Another crew member then probes the ground with a fiberglass stick to determine whether there's a buried land mine, and then marks the spot for digging. Prodding with too much force can detonate the mine. False alarms are common in earth that has a naturally high metallic content or buried metal debris.

But debris is not the biggest problem. Metal detonators and firing pins in plastic mines can weigh as little as 0.6 gram, making them impossible for the most sensitive metal detector to find. Some plastic mines may have no metal at all.

Because of difficulties with plastics, sensors are being developed to detect thermal, chemical, or dielectric changes in the soil that could be caused by plastic or other mines.

NEW INITIATIVE SPURS R&D Most of the funds for demining technology today come from the U.S. military, which has both the money and the need. Certainly, soldiers need something more efficient than a stick to probe the ground. The military has turned to academia for expertise.

"Five years ago, the U.S. government made a very significant investment in getting universities involved," says IEEE Fellow Lawrence Carin [see photo, p. 1], a land-mine-detection expert and a professor of electrical and computer engineering at Duke University, Durham, N.C., USA. "That move made a huge difference in the field. Researchers at universities looked at the problems of land-mine technology with fresh eyes."

The U.S. Directorate of Defense Research and Engineering, part of the Department of Defense, created and funded the Multi University Research Initiative, or MURI, which is managed by the U.S. Army's Research Office, in Durham. Among those working on countermining projects are the University of Florida, Ohio State University, the University of Memphis, as well as the University of Missouri-Columbia and Duke.

Previously work was done in a very nonsystematic way, primarily by small companies without enough people or time to investigate new possibilities, says Carin, coauthor of the paper "Alternatives for Land Mine Detection," published in February 2003 by the RAND Science and Technology Policy Institute, Arlington, Va., USA.

MURI is funding about a dozen technical approaches because there is no consensus yet about which is best. Some of the technologies are further along, while others are in the initial stages of development. Several of them are described below, and others are presented in the table, "Other Detection Technologies" [left].

Although these applications are for the military, once developed, some of these devices could be used for humanitarian demining projects.

NEW SENSORS Ground penetrating radar (GPR), perhaps the most advanced of the new technologies, can detect both metal and plastic mines in a variety of soils. GPR sends a series of microwave pulses ranging from 1 to 4 GHz into the ground. It then looks for anomalies in the reflected signal that could indicate mines. But its imperfect signal processing can be fooled. The technique has proven most effective at spotting mines buried one to two meters deep, where antitank mines are usually hidden.

GPR gear has been packaged in several ways: on a platform mounted on a vehicle similar to a Humvee, in hand-held devices, on remotely controlled vehicles like robots, or even in helicopters that sweep the ground for mines.

"Although GPR has been shown to be effective on a test track against a variety of land mines in a range of soil conditions, it is technologically complex," according to "Land Mine Detection," an article in *IEEE Instrumentation & Measurement* magazine (December 2002), written by IEEE Member Rob Siegel. He's with Geo-Centers Inc., a company in Newton, Mass., USA, that builds mine-detection systems.

Another drawback of GPR is the substantial time it takes to process the data and then "decide whether to dig in a particular location," says Senior Member Ismail Jouny. The department chair in the electrical and computer engineering department at Lafayette College, in Easton, Pa., USA, Jouny is working on algorithms for mine detection systems.

"A brick or piece of metal in the ground can confuse the GPR sensor," Jouny says. He outlined some of the problems in "Clutter Suppression and Feature Extraction for Land Mine Detection Using Ground Penetrating Radar," a paper he presented at the 2003 IEEE Antennas and Propagation Society's International Symposium.

Another kind of sensor, around since Alexander Graham Bell's time, relies on

Other Detection Technologies

TECHNOLOGY	OPERATING PRINCIPLE
Acoustic/seismic	Examines acoustic waves reflected by mines
Biological (dogs, bees, bacteria)	Living organisms react to explosives vapors
Electrochemical	Measures changes in electrical resistance
Infrared	Measures heat differences in the soil
Neutron	Induces radiation emissions from the explosive's atomic nuclei
Piezoelectric	Measures the shift in resonant frequency of various materials exposed to explosives vapors

Ground penetrating radar is the key sensor on this wheeled vehicle, which can detect metallic and nonmetallic antitank mines. Built by Geo-Centers Inc., the system can be operated remotely and has automatic target recognition.

electromagnetic induction (EMI). It is being used in highly sensitive metal detectors that can find very small amounts of metal in the wiring of plastic mines. EMI induces electric currents in metal and these currents create a field that can be sensed.

Other promising technologies include quadrupole resonance (QR) and optical techniques. QR uses magnetic high-frequency pulses to which explosive compounds like TNT have been found to react. The pulses cause the chemical bonds in the explosive to resonate, and the detector senses this effect.

Scanning the ground with infrared is an optical technique used to detect trip wires, a feature of some land mines. "If you look at vegetation with near infrared, it's very bright, whereas man-made objects tend to be dark, so you can sometimes see the wires easily," says IEEE Fellow Paul D. Gader, a professor of computer and electrical engineering at the University of Florida in Gainesville, USA. Gader has just begun testing an infrared system.

ANALYZING IT ALL Other IEEE members are concentrating on techniques for processing signals gathered by the sensors. For example, Keller, at the University of Missouri, and Member Hichem Frigui at the University of Memphis in Tennessee, USA, are using fuzzy logic to process the data from radar sensors.

"Fuzzy logic is simply a way to deal with uncertainty," Keller explains. "It's how to get computers to make decisions that are closer to the way humans might make a decision, with incomplete or uncertain information." No mine returns a perfect signal, "so we need something that explicitly deals with uncertainty," he says.

This approach is described in a technical paper coauthored by Keller and Gader, "Recognition Technology for the Detection of Buried Land Mines," which appeared in *IEEE Transactions on Fuzzy Systems* (February 2001).

"Decisions about demining have to be made in real time, and there's only a fraction of a second to process the data and decide if a mine is there," Frigui says. "Instead of using large amounts of data to represent a mine, we try to represent it with a few key features."

He's proposed a system that relies on a small library of mine characteristics, called signatures. They're grouped into four classes: strong mines, weak mines, false alarms, and background noise. Frigui described his techniques in "Detection of Land Mines Using Fuzzy and Possibilistic Membership Functions," which appeared in the *2003 Proceedings of The IEEE International Conference on Fuzzy Systems*.

"The goal is to develop an algorithm simple enough so that a soldier looking at a display screen or even an automatic system can read the signals and decide if there's a mine," he says.

COORDINATED SENSORS Each sensor has its drawbacks, detecting one type of mine well but failing to detect others. "Where induction does well, QR could do poorly," Carin says. "But if you bring them together collectively, the combination does well."

In his RAND report, Carin concluded that given the limitations of individual sensors, any major breakthrough in mine detection probably will require a multisensor system. ●

ENTREPRENEURS from page 1

neurs run their businesses from their dens or kitchen tables.

"Right now I'm working out of my home—partially for cost savings and because there's nothing more convenient than going up the stairs when you need to work, rather than driving somewhere," says Erin Mace, member and cofounder of Savant Engineering, a design firm that specializes in commercial buildings, in Atlanta, Ga., USA.

Mace reports that besides a commute measured in minutes rather than hours, running a business out of her home also gives her more flexibility when caring for her two-year-old daughter, Hannah.

"This morning I was able to spend a few extra hours with Hannah before she went to day care, because she was feeling sick," Mace says. "I don't typically work when she's at home, because Hannah is very active and not conducive to a business environment."

Besides the independence you gain in running your own business, entrepreneurship can be financially rewarding.

"If you can stay busy as a contractor, you're going to make more money than at a traditional job," says Eric Anderson, an IEEE member and owner of Andar Engineering Inc., a business specializing in BIOS (short for basic input/output system) programming in Minneapolis, Minn., USA, since 1998.

Any start-up—engineering or otherwise—carries risk, but Mace, for one, keeps it in perspective.

"The worst-case scenario is that I go back to working for someone else," Mace says.

Erin Mace

SECRETS OF SUCCESS An engineer looking to start a small business might begin by thinking about introducing a new technology or product. After all, engineers know high-tech best.

But Berube doesn't recommend that. Instead he suggests that fledgling entrepreneurs might find it easier if they could offer a competitive advantage for a product that's already out on the market or a special service that isn't otherwise available. While it sounds simple, in practice it's not. Dave Callahan, who teaches a class on entrepreneurship at the University of Alabama at Birmingham, recommends seeking advice from one of the best sources around, fellow entrepreneurs.

"In every city, there seems to be a community of entrepreneurs," Callahan says. "Most of them are serial entrepreneurs and want to be helpful to others. The number one thing to do is seek advice." Engineers may find this particularly valuable advice, he says, because they tend to think they are expert in everything and generally try to do too much themselves.

Anderson suggests enlisting a team of legal, financial, and accounting experts to contribute knowledge the engineer does not have.

But John Cosgrove, a member who has run his own computer consulting company, in Playa del Rey, Calif., USA, has an inexpensive method for getting the help he needs.

"I borrowed the term 'favor bank,' from the novel *The Bonfire of the Vanities* by Tom Wolfe, meaning you help yourself by helping others," Cosgrove says. "You make sure people owe you more than you owe them. If somebody comes to you for help, you stop what

Despite stacks of research and months of preparation, some engineering entrepreneurs discovered they had to find out how to run a successful business by MAKING MISTAKES

you're doing and do what is needed because that person is going to feel an obligation to help that's going to pay off for you later."

Small business owners can also gain the expertise they need just by observing how other businesses run, according to Callahan.

"When you work for a company, you often want to say, 'That's a stupid decision,'" he says. "Sometimes it is. But sometimes when you start asking questions of the right people, you recognize that there might be some tax or market implications you might not have seen."

Some secrets of small-business success offered by established entrepreneurs are less tangible. Cosgrove emphasizes a good balance between work and personal life.

"I've always had outside interests that give me a certain amount of balance, so I'm not stuck in a narrow technical view of the world," Cosgrove says. He's serving on three volunteer boards and is involved in the Jane Austen Society, a group that meets to study the works of the English novelist.

Roberto Poujol

As trite as it may sound, Member Holger Ronquist stresses the power of positive thinking. He is the cofounder of 42Networks, a telecommunications company with 16 employees that provides telephony and video systems that operate on the Internet in Stockholm, Sweden.

"First of all, you must believe in what you're doing— then you must have courage, because without it, you'll do nothing," Ronquist says. "All the rest are technicalities."

LEARNING WHAT WORKS Despite stacks of research and months of preparation, some entrepreneurs discover that they find out how to run a successful business by making mistakes.

"We learned by breaking things," says Member Roberto Poujol, general manager and one of eight partners of Telexpertise Mexico in Saltillo. The company was formed out of a Mexican division of L.M. Ericsson that closed in 2002 after the telecom crisis. "My partners and I lacked experience in sales and marketing. We all came from R&D and engineering, so we had to develop skills in positioning our company and making sales calls."

Many other engineering entrepreneurs find themselves in the same situation as Poujol. About half the entrepreneurs *The Institute* interviewed for this article said they found marketing and selling themselves troublesome.

"I think I might be a stereotypical engineer in that I don't know how to go out and sell my business," software-programming contractor Anderson says. "To come into a company that doesn't know me and convince them that I can pull a team together to design anything needed is not easy."

Commercial building designer Mace also found that her responsibilities went beyond sales and marketing.

"I wish I was a little more prepared for the extras and how much time they would require," she says. As the only person in her office, Mace also must order supplies and fix her computers. "It's frustrating because all I want to do is design."

Some business lessons are only learned the hard way. Anderson, who is now looking for a full-time corporate job after contract work dried up, suffered from the dot-com fever that infected the stock market five years ago.

"I took all the extra money I made from my business and put it in the stock market," he says. "My stock portfolio was the who's who of where not to invest during the late 1990s. I tended to put my money in high-tech businesses because that's what I thought I knew."

Anderson says the money his business lost in the stock market could have sustained him for a year. Now, he recommends diversifying investments and hiring a financial advisor.

THE FLIP SIDE Although a small business can offer an engineer independence and creativity, it can also bring financial insecurity.

"People think the hard part is getting clients," Cosgrove says. "That's important, but the really hard part of running a business is getting paid for your product or service." For an engineer who worked in industry before becoming an entrepreneur, receiving a paycheck every two weeks that doesn't bounce was a given, Cosgrove says. As an entrepreneur, that is no longer true.

"Nobody cares whether you get paid except you," he says.

Berube says getting his invoices paid can take from two weeks to up to two months.

"I would describe my business as only marginally successful, because I can't feed myself yet," Berube says. "During the past four months, I ran out of contract funds on the projects I was working on, although there's still work for my employee. So I laid myself off." He recently took a full-time job with a large corporation, but still runs his business on the side.

An entrepreneur with a number of employees has the added pressure of not only supporting his or her family, but also the employees' families.

"I have 32 employees, who support about 240 people in their families," says Member Fritz Braun Jr., who in 1993 started Biotek Pharmaceutical Industries Ltd., a biomedical-engineering research and manufacturing facility, in Rio de Janeiro, Brazil. "When we make decisions, we have to remember that we're feeding 240 people."

Berube avoided that situation by making an unusual hire, a retired engineer who receives a pension and doesn't need a regular paycheck.

"My one employee's health insurance is taken care of by his retirement plan, and he doesn't care when he gets paid," Berube says.

For some entrepreneurs, the biggest challenge doesn't come from competition or the bottom line, but from the country the entrepreneur works in. Braun in Brazil, Ronquist in Sweden, and Poujol in Mexico report that with no tradition of technological entrepreneurship in their countries, starting a small engineering business was difficult.

"Brazil has got to be one of the toughest places to start a business, because of the bureaucracy," Braun says. He opened a subsidiary for his company in Melbourne, Fla., USA, in less than a week. He says the same process in Brazil takes at least six months.

In 1970, when Ronquist started his first business, developing word processing equipment, in Sweden, the climate for a small business owner was difficult.

"Government authorities looked at you with suspicion 30 years ago," he says. "Today entrepreneurs are a bit more accepted." Ronquist says that high taxes in Sweden make saving money for investments in a business difficult. Like Poujol's firm, Ronquist's company is a spinoff from Ericsson.

"Telexpertise Mexico is a curiosity for our area, because Mexico is not known for telecom technology services," Poujol says. "But we have to start creating our own success stories in Mexico. If we don't do it for ourselves, no one else will do it for us."

FOR MORE on some of the organizations mentioned in this article, visit their Web sites.

Telexpertise Mexico:
http://www.txm.com.mx

Cosgrove Computing:
http://www.cosgrovecomputer.com

42Networks: http://www.42Networks.com

Biotek Pharmaceutical Industries Ltd.:
http://www.biotekbr.com

University of Alabama at Birmingham
Information Engineering and Management
program: http://www.eng.uab.edu/iem

LETTERS

Feeling Green

Was it an accident or deliberate that the brain scan shown in the article "Seeing the Invisible" was in green [December, p. 1]? I have always advocated the use of green as the color for such images because of my background in the design of color television in the 1950s.

Green dominated the range of colors that our eyes see or our brains interpret. Could this be attributed to our ancient need to observe what's going on in the jungles of prehistoric humans? Whatever the reason, I think radiologists interpreting imaging scans and X-rays could benefit from seeing the images in green so as to better analyze subtle differences in what's displayed.

Greenish hue of a magnetic resonance image could make its analysis easier.

ALAN O. PLAIT
Sarasota, Fla., USA

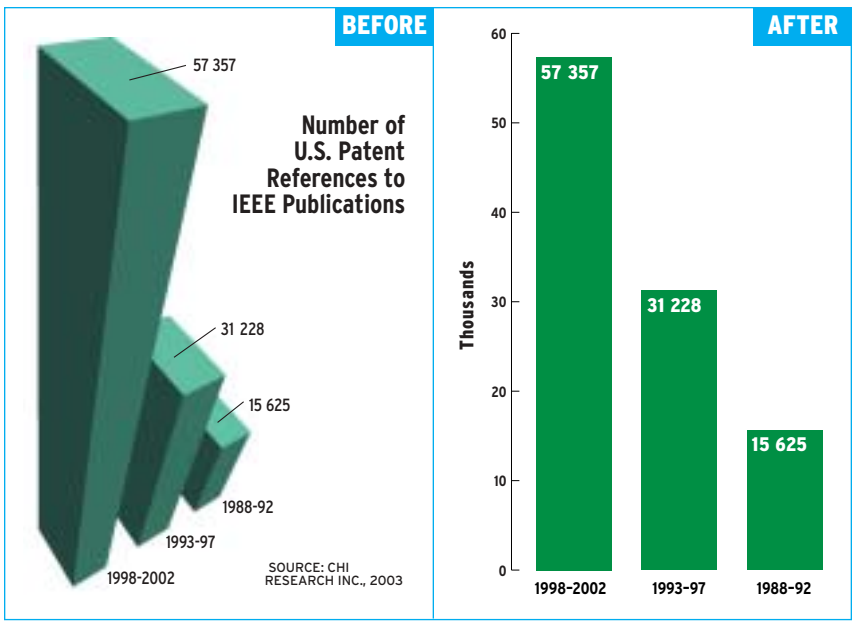
The editor responds: Our use of green was a happy accident.

Off the Charts

In the December issue [p. 18], two charts were intended to demonstrate the popularity of IEEE publications. The charts use a common technique to exploit perspective to exaggerate the data. For example, the chart labeled "Number of U.S. Patent References to IEEE Publications" shows the 1998–2002 bar as 57 357 and the 1993–97 bar as 31 228. However, the 1998–2002 bar is over twice the height of the 1993–97 bar because of distortion of perspective. While it is helpful that numbers are attached to the bars, that doesn't excuse the exploitation of the reader's visual sense of scale.

A simple, flat bar chart would have been enough. I would ask the editors to eliminate these false charts from their graphical lexicon.

TIM DAVIS
Broomfield, Colo., USA



Using perspective, as* The Institute *did to make a bar chart look more interesting [left], gives a false impression of relative size, says reader Tim Davis. Though the numbers on the bars help, he says, he much prefers a simple flat bar chart [right].

TELL US WHAT YOU THINK

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

Mail: *The Institute*, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ USA 08855-1331
Fax: +1 732 235 1626
E-mail: institute@ieee.org

Why So Few Women Profs?

A STUDY FROM the University of Oklahoma in Norman, USA, reports that in science and engineering, electrical engineering has one of the lowest percentages of female assistant professors at U.S. research universities—only 10.9 percent. Why are so few women on EE faculties?

RESPOND TO THIS QUESTION by e-mail or regular mail. It's unlikely that space will permit publication of all responses, although we'll try to draw a representative sample. Your comments are subject to editing for brevity. Suggestions for questions are welcome. Your answers will appear in the June issue of *The Institute*.

E-MAIL: institute@ieee.org

MAIL: The Institute, IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ, USA 08855-1331. Fax: +1 732 235 1626.

RESPONSES TO DECEMBER'S QUESTION

What Can Engineers Do to Prevent Large-Scale Blackouts From Happening Again?

Engineers Can Do It!

Those of us in the power industry intuitively understand what to do because we understand the principles of integrated power-system operation.We also understand how to increase system reliability and mitigate the effects of system disturbances. We should have the chance to apply our expertise.

Those who are now making the regulatory and investment decisions don't even try to understand the technical consequences of what they do. We should invest prudently in power and communication systems and rely on qualified power engineers empowered to make the appropriate decisions.

CHARLIE PENCINGER
Westwood, Mass., USA

Feeling Threatened

We will have to face the threat of blackouts with more frequency in the next few years. We are paying for the bad decisions our politicians made years ago.

In Italy we had a referendum in the late 1980s, right after the Chernobyl nuclear disaster. This referendum prompted the Italian government to close down nuclear power facilities—a big mistake, in my opinion. The nation's energy future was put in the hands of ignorant politicians and people with no technical expertise.

The situation is going to get even worse when we have to face the huge demand for power needed when electric cars become a reality. We are living on a razor's edge. What will happen tomorrow if we don't have an energy alternative?

ANDREA BUCCI
Torino, Italy

We're Not Alone

Engineers alone can do little to prevent blackouts. They depend on many factors, such as inadequate maintenance budgets for plants and transmission facilities, policies adopted to mitigate legal liabilities, and low-cost plant designs made on the assumption that the transmission network can always restart the plant. Engineers can, however, point out the negative effects of reliability caused by these decisions.

It is up to policy-makers, legislators, and regulators to steer the power industry's emphasis away from increasing financial returns to increasing reliability. Engineers are experts in analyzing solutions to maximize effectiveness and in devising new control systems to communicate and respond faster—and with more intelligence than the systems did last August.

GEORGE GLADFELTER
Rapid City, S.D., USA

Wrestle Back Control

The engineers first will have to take back control of the electric power industry from the economists, accountants, and lawyers. Engineers have done what they can under the current circumstances: developing technologies that squeeze the last megawatt of power out of the existing infrastructure while necessary investment is deferred permanently. In the process, reliability is reduced to zero. Then it becomes a matter of when large-scale blackouts will occur. The rules the economists and regulators set up leave no room to fund research to develop new technologies.

Engineers should be the ones to regulate electric power systems. We know enough about power-system economics to install regulations that will guarantee healthy bottom lines and highly reliable energy. With our help, the likelihood of large-scale blackouts will be considerably reduced.

F. A. SOMOLU
Lagos, Nigeria

Ethical Responsibility

As Jack Casazza points out in "Engineering, Ethics & Electricity" [*IEEE Spectrum*, July 2003, p. 11], "engineers must share the blame for the billion-dollar debacles in the utility industry."

The control of the health of the power system has passed from the hands of engineers, in the old vertically integrated utility model, to the hands of accountants, risk managers—who manage fiscal and legal risk, not technical risk—and marketers. As Casazza points out, engineers need to behave ethically toward the employer (that is, contribute to the bottom line), but should not do so if it jeopardizes public safety, as power failures do in numerous ways. This is easier said than done when your job is at risk.

Engineers can propose technical fixes to problems such as transmission overloading, inadequate maintenance, and insufficient operational visibility, but these will be implemented only if managers invest funds in projects that will not bear profits immediately. If engineers demonstrate ethical behavior and insist on these investments, then the corporate executives eventually will have to come around because they need the engineers to design, build, and operate their investments.

Engineers should act ethically under all circumstances, recognizing their responsibility to the general public even at the risk of losing their jobs.

LASZLO JAMNICZKY
Calgary, Alta., Canada

Dramatic Failures

I believe the grid has become more reliable overall. However, it also appears that when it does fail, it does so in a big way. I see an analogy with mountain climbers tied together for safety. If one slips, the other climbers can provide the protection. But if enough of the climbers fall, their interconnection dooms them all.

The electric power grid seems to suffer similarly from the addition of nodes of generating points. The addition of one node seems to decrease the odds of failure, but dramatically increases the extent of the failure when it does occur. Additional safeguards seem to complicate the system to the point where the safeguards themselves become sources of unreliability.

In the long run, I feel additional independent, distributed generation will be more effective than trying to increase the reliability of a behemoth system with almost infinite variables.

JOHN J. CHRISTIANO
Franklin, N.J., USA

Seeing Connections

Recent extensive power failures occurred because when adjacent systems are solidly connected together, a fault anywhere instantly affects both systems. The only way to prevent this is to have an asynchronous connection, such as a dc connection with rectification and inversion at both ends.

I believe Hydro-Québec used this method for its connection to the province of New Brunswick to prevent troubles from affecting Quebec. I believe it has worked successfully, but, of course, such a connection is expensive. Until asynchronous connections between major systems are common, blackouts will continue to occur.

H.R. LUCAS
Toronto

The Grid Works

Engineers can do nothing to prevent large-scale blackouts unless legislators and utility executives allow generation, transmission, and distribution systems to operate as an integrated enterprise. Today the operation is controlled by those with political and economic power, and not by those with technical knowledge.

The reaction to the August 2003 blackout has been to condemn the grid as being old, out of date, and obsolete. Nonsense! With deregulation and the desire to control large amounts of power over long distances, the transmission systems were made to work in ways they were not originally designed for.

The blackout was caused by the power system operating exactly as it was supposed to: turning itself off to prevent destruction.

BRAD PEASELEY
Richmond, Va., USA

Déjà Vu?

Many years ago I was driving home when I heard the music on the radio slow down. Seconds later the radio went silent and New York City went dark.

Much of the blame for blackouts falls on poor government regulation, which I don't expect to improve. We need simple solutions to the problem of losing synchronization and a stronger network to carry the power.

The solution would be for the government to convert most transmission lines to direct current. The existing lines could then handle almost 50 percent more power and synchronization problems would disappear.

CYRUS F. AULT
Cherokee Village, Ariz., USA

Nomination Alert: The Deadlines Are Coming

THE IEEE NOMINATIONS & Appointments (N&A) Committee seeks nominations for both appointed and elected volunteer positions. The N&A Committee recommends to the IEEE Board of Directors candidates for appointment to standing committees and to major boards.

Committees with openings are: Admission and Advancement, Audit, Awards Board, Credentials, Employee Benefits, Ethics and Member Conduct, Fellow, History, Individual Benefits and Services, Information Technology Strategy, Life Members, Meetings and Services (Chair only), Membership Development (Chair only), Nominations and Appointments, Publication Services and Products Board (PSPB) (Members-at-Large only), Strategic Planning, Tellers, and Women in Engineering.

Nominations are also needed for the 2006 IEEE President-Elect and for Assembly-elected officers: Vice President–Educational Activities, Vice President–Publication Services and Products, IEEE Secretary/Treasurer or IEEE Secretary and IEEE Treasurer.

General qualifications for volunteer service are competence, experience, a willingness to take on the task, time to participate, enthusiasm, vigor, and the ability to cooperate with others in achieving the objectives of the committee or board.

Recommendations for positions can be made throughout the year at http://www.ieee.org/committee/nac/nomform.xml or by fax to IEEE N&A Staff Secretary at +1 732 981 9515.

All recommendations will be forwarded to the N&A Committee for consideration.

ELECTED POSITIONS On 1 May, the IEEE Board of Directors will announce the candidates for elective positions who are to be placed on the 2004 annual election ballot. Their terms will begin in 2005.

The list of candidates will include nominees for IEEE President-Elect recommended by the IEEE N&A Committee and approved by the IEEE Board of Directors. Other candidates will be nominees for Director and Director-Elect positions submitted by the respective regional and divisional nominating committees. The ballot will also include the nominees for Standards Association Members-at-Large, Technical Activities Vice President-Elect, and IEEE-USA President-Elect and Member-at-Large.

Prior to 1 May, the Board will also consider placing on the ballot any proposed constitutional amendments [see "Amending the IEEE's Constitution," p. 4]

Members who have not been nominated but who want to run for office may do so by filing written petitions to the BoD by noon Eastern Time, 11 June 2004. To be eligible to be on the ballot, a member must accompany his or her petition with the necessary number of valid voting members' signatures and meet other requirements.

2004 Deadlines at a Glance

15 March	Regional committees submit candidates for open offices of Regional Delegate-Elect/Director-Elect
	Divisional nominating committees submit candidates for the office of Divisional Delegate/Director or Divisional Delegate-Elect/Director-Elect, as applicable
	Standards Association submits candidates for the offices of Standards Association Board of Governors Members-at-Large
	Technical Activities submits candidates for the office of Technical Activities Vice President-Elect
	IEEE–USA submits candidates for the offices of IEEE–USA President-Elect and IEEE–USA Member-at-Large
	Recommendations to IEEE Nominations and Appointments Committee for candidates to 2005 Standing Committees, Assembly-elected positions, and 2006 President-Elect
1 May	Board of Directors submits to the voting membership a list of nominees for President-Elect; Delegate/Director or Delegate-Elect/Director-Elect, as applicable; and other positions to be elected by voting members for the coming term
	Board of Directors announces its intention to put forward a constitutional amendment(s)
11 June	(Noon EST) Petitions for constitutional amendments must be received
	(Noon EST) Petition nominations for candidates to be elected by the membership must be received
	Initial statements by principal initiators and opponents of constitutional amendments must be received
	Corporate Activities must receive initial statements from all annual election candidates
21 June	Corporate Activities mails initial statements by proponents of proposed constitutional amendments to opponents and opponents' initial statements to proponents
2 July	Deadline for rebuttal statements from initiators and opponents on constitutional amendment proposals
1 Sept.	IEEE annual election ballots are sent to all voting members of Regions 1–10
1 Nov.	(Noon EST) Last day for ballots to be returned by voting members
8 Nov.	Last day for ballots to be tallied by Tellers Committee
11 Nov.	Last day for announcement of vote tally by Tellers Committee to IEEE Board of Directors
18 Nov.	Election of officers by IEEE Assembly
21 Nov.	Assembly election results announced
	IEEE Board of Directors acts to accept report of Tellers Committee
	IEEE Annual Election and Assembly election results are made official

OFFICES UP FOR ELECTION

Chosen by all voting members:
- President-Elect

Chosen by members in Regions 1–6:
- IEEE–USA President-Elect
- IEEE–USA Member-at-Large

Chosen by members of the IEEE Standards Association:
- IEEE Standards Association Board of Governors Members-at-Large

Chosen by members of the respective Technical Divisions:
- Technical Activities Vice President-Elect
- Director, Division II (two-year term)
- Director, Division VI (two-year term)
- Director, Division X (two-year term)
- Director-Elect, Division I (one-year term)
- Director-Elect, Division III (one-year term)
- Director-Elect, Division V (one-year term)
- Director-Elect, Division IX (one-year term)

Chosen by members of the respective Regions:
- Director-Elect, Region 2 (two-year term)
- Director-Elect, Region 4 (two-year term)
- Director-Elect, Region 6 (two-year term)
- Director-Elect, Region 10 (two-year term)

FOR MORE INFORMATION...

...on election procedures, contact Angela Wyckoff, IEEE Corporate Activities at +1 732 562 3934; e-mail: a.wyckoff@ieee.org.

MEMBER RECOGNITION

Acoustics Expert Receives U.S. National Medal of Science

BY KATHY KOWALENKO

HE'S BEEN A RENOWNED acoustical scientist, an entrepreneur, a force behind the Internet, and CEO of a television station. These are just some of the reasons that Life Fellow Leo Beranek received the U.S. National Medal of Science in the engineering category last November. U.S. President George W. Bush cited Beranek at a White House ceremony for his leadership, dedication, and contributions to the art and science of acoustics, for his role as cofounder of one of the world's foremost acoustical research and consulting firms, and for sustained contributions to scientific societies and civic organizations.

Administered by the National Science Foundation's Science Board, the award is the nation's highest honor in science. It is given to those who make outstanding contributions to biological, chemical, engineering, mathematical, and physical sciences.

"Getting the award was very surprising, because I was chosen from among many research engineers in the United States," Beranek told *The Institute*. "Why they picked me, I don't know."

Beranek is perhaps best known as a cofounder of Bolt, Beranek, and Newman (BBN). He formed the partnership in 1948 with Richard H. Bolt and Robert B. Newman, whom he met the year after becoming an associate professor at the Massachusetts Institute of Technology in Cambridge, USA. BBN'S original forte was providing acoustic research and noise control services to music schools, office buildings, auditoriums, concert halls, and opera houses.

In 1969, after assembling a powerful software group, the company was also instrumental in building ARPANET, the first packet-switched computer network. Created for the U.S. Advanced Research Project Agency (ARPA), it was designed to link widely separated high-speed computers. BBN's involvement began with its purchase of one of the first transistor-digital computers. This led the company to contracts with ARPA, one of which was to build the interface to ARPANET's message processors, which was the forerunner of the Internet.

In 1940, after earning a doctorate in physics from Harvard University, Cambridge, Mass., USA, Beranek became a faculty instructor there and was appointed director of Harvard's Electro-Acoustics Laboratory, where he helped solve problems of voice communication and high noise levels in military aircraft.

Leo Beranek [left] receives the National Medal of Science from U.S. President George W. Bush.

Later he worked as director of the U.S. Naval Research Laboratory at Beavertail Point, Jamestown, R.I., USA, where he helped improve the communications, radar detection, and gunnery systems on U.S. Navy ships. This work earned him the U.S. Presidential Certificate of Merit in 1948.

After leaving BBN in 1971, Beranek was president and CEO of WCVB, a Boston television station. Later he served on the board of directors of Wang Laboratories in Lowell, Mass., USA, a computer company. Leaving Wang before it went bankrupt in 1983, he became chairman of the Boston Symphony Orchestra and then president of the American Academy of Arts and Sciences, a volunteer position.

At age 78, Beranek became an acoustical consultant to several Japanese architects. Between 1990 and 2001, he helped design five concert halls and two theaters in that country.

At age 89 he hasn't slowed down. Last December, he released the second edition of his book, *Concert Halls and Opera Houses: Music, Acoustics, and Architecture* (Springer-Verlag). In it, he ranks the acoustics of 58 concert halls and 21 opera houses around the world and profiles 100 of them.

To read Beranek's oral history, produced by the IEEE History Center, visit http://www.ieee.org/organizations/history_center/oral_histories/transcripts/beranek.htm. ●

IN MEMORIAM

Nikolai N. Sheremetevsky, Simon Ramo Medal Recipient

BY HENRICH S. LANTSBERG
Vice Chair, IEEE Russia Section, Head of the Institute of Radioengineering & Electronics, Russian Academy of Sciences

NIKOLAI N. SHEREMETEVSKY received many international and Russian awards during his life, but he was most eager to receive the IEEE Simon Ramo Medal. Unfortunately the news in December that he had won the medal for 2004 came too late for Nikolai. He died last July. Nikolai shared the medal with Boris E. Chertok for their contributions to systems engineering and technical leadership of the control systems design for the Mir orbiting space station.

Nikolai was a leader in modern system science and engineering. His colleagues in the West recognized his talent and skill, but he was admired most in the former Soviet Union, where for more than 50 years he was considered one of the top inventors in this field.

In 1941 Nikolai joined the Scientific and Industrial Enterprise All-Russia Research Institute of Electromechanics in Moscow, devoting his career to this institute and eventually becoming the advisor to the organization's director. Several inventions of automated systems and control devices associated with him have been widely implemented in space technology, including those onboard the spaceships designed at the institute.

Nikolai played a major role in developing new gyroscopes used to orient and stabilize the Salute and Mir space stations. During his tenure at the institute, research teams he led designed gyroscopic control systems for Mir that have an accuracy of less than one angle minute, a system that orients solar panels for a 90-kW power supply, and engines that provide automatic orientation of the ship's communications antennas.

The research teams also developed control systems for Mir that allow the space station to reorient itself quickly and guide telescopes on the station accurately. This last feature allowed astronomers to discover a new supernova in the Magellanic space cloud.

In addition, under Nikolai's leadership, scientists and engineers developed other things, including powerful rotors on magnetically suspended, cryogenically cooled electrical machines and mobile power equipment. Also under his supervision, R&D on automated design systems provided the impetus to deploy computer technology in the electric power industry.

NIKOLAI N. SHEREMETEVSKY, 87
DIED: 29 July 2003
MEMBER GRADE: Member
EDUCATION: Moscow Power Engineering Institute
FIELD OF INTEREST: Electrical Engineering
CAREER MILESTONES: Worked at the All-Russian Institute of Electromechanics in Moscow, starting as a researcher in 1941; at his death he was serving as the adviser to the institute's director.
AWARDS: State Prizes, 1949 and 1967; Honored Man in Science and Technology, 1971; Lenin Prize, 1978; Full Member, USSR Academy of Sciences, 1984; Hero of Labor, 1986; Member of Electrotechnical Academy, 1991; Honorary Member of K.E. Ziolkovsky Astronautical Academy, 1994; Simon Ramo Medal, 2004.

Nikolai had a great talent for organizing the process of science and technology research. He was a thoughtful, cultured, and educated man. His great contributions in science and technology will always be remembered.

He was a valued friend and colleague to many of us. Nikolai will be missed by all who knew and respected him. ●

Congratulations to The Class of 2004

FOR NOTEWORTHY CONTRIBUTIONS to the advancement or application of engineering, science, or technology, 260 new IEEE Fellows were named by the IEEE Board of Directors. They were cited for everything from developing three-dimensional medical imaging and processing to building intelligent robots. Each January, the IEEE Board of Directors awards the designation of Fellow to no more than 0.1 percent of the voting membership as of 31 December of the preceding year. Today, there are more than 5400 IEEE Fellows.

Alejandro Acero
Shirabe Akita
Jan I.H. Askne
Les Eugene Atlas
Er-Wei Bai
Harbans L. Bajaj
Wamadeva Balachandran
Gary J. Balas
Miroslav Miodrag Begovic
Jerome R. Bellegarda
Jon Atli Benediktsson
Nihat Bilgutay
Chatschik Bisdikian
Jerome John Blair
Mark Thomas Bohr
Piero P. Bonissone
Kim Boyer
Thomas Joseph Brazil
Kevin Francis Brennan
Gary B. Bronner
Michael Jesse Buckler
James Antonio Bucklew
Constantin Bulucea
Yan Cheong Chan
Rajen Chanchani
Anantha P. Chandrakasan
Venkatachalam Chandrasekar
Cheng-Shang Chang
Dau-Chyrh Chang
Shih-Fu Chang
Hsing-Yao Chen
Ming-Syan Chen
Ray T. Chen
Xuemin Chen
Edwin Chong
Philip A. Chou
Antonio J. Conejo
Jonothon A. Crowcroft
Thomas Allen Cwik
Frederica Darema
Bart L.R. De Moor
Casimer DeCusatis
Serge N. Demidenko
Denice Denton
Frank DeWinter
Atam P. Dhawan
John McG. Dobbs
Robert R. Doering
Edmund Durfee
Robert Howard Eklund
Aly Elrefaie
Joel S. Emer
Per Enge
John S. Engelhardt
Gary Roy Engmann
Deborah Estrin
Tuvi Etzion
Djalma Mosqueira Falcao
James Farmer
Aly E. Fathy
Arie Feuer
Julie Elizabeth Fouquet
Alexander Lvovich Fradkov
Li-Chen Fu
Minyue Fu
Thomas Edward Fuja
Hiromu Fujioka
Vincent Francis Fusco
Vijay K. Garg
Richard L. Garwin
Stephen D. Gedney
Ronald Barry Goldfarb
Evan Lee Goldstein
Forouzan Golshani
Turan Gonen
Stephen Marshall Goodnick
William Eric Leifur Grimson
Grant Theodore Gullberg
Rajesh K. Gupta
Robert Alexander Hanna
Donald W. Hanson
Lajos Hanzo
Bin He
Erik H.M. Heijne
Graham Reginald Hellestrand
John William Helton
Charles F. Henville
Stephen D. Hersee
William Evan Higgins
Robert T. Hill
Ralph Leroy Hollis
Christopher Hollot
Xianlong Hong
Chaohuan Hou
Jerry Hudgins
Kenji Iba
Nathan Ida
Masao Ikeda
Shuji Ikeda
Adrian Ionovici
George W. Irwin
Masaru Ishii
Hajime Ishikawa
Masayuki Izutsu
Robert W. Jackson
Bahram Jalali
Pankaj Jalote
Mrdjan J. Jankovic
Augustus J.E.M. Janssen
Ya-Qiu Jin
R. Wayne Johnson
Dilip Dinkar Kandlur
Kenneth James Kerpez
Beomsup Kim
Harold Kirkham
Daniel Koditschek
Yasuo Kuga
Sanjeev R. Kulkarni
Spencer P. Kuo
Kenneth Meade Lakin
Amos Lapidoth
Richard Michael Leahy
Jean-Yves LeBoudec
J.J. Lee
Russell Jean Lefevre
Jean-Luc Bernard Leray
Xiao-Rong Li
Jack N. Little
Yilu Liu
Jerry D. Lloyd
Hans-Andrea Loeliger
Michael Rung-Tsong Lyu
Stefano Maci
Shoji Makino
Giuliano Manara
Michael Jay Marcus
Colin Craig McAndrew
James Dickey McCalley
Michael Joseph McLaughlin
Meyya Meyyappan
Yukou Mochida
Alberto Moreira
Koso Murakami
Edmond Murphy
Richard M. Murray
Yukihiro Nakamura
Vishvjit Singh Nalwa
Seiichi Namba
Robert Mark Nelms
Steven A. Newton
Jurgen Nitsch
Alexander Nosich
Hiroshi Nozawa
Bruce Mitchell Nyman
Takashi Ohira
Patrick Gerard O'Shea
Mikael Ostling
Bjorn Erik Ottersten
Edward La Verne Owen
Bradley Paden
Surendra Pal
Krishna Palem
Vladimir Parizhsky
Yong Kwan Park
Stuart Parkin
Bradford Parkinson
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S. Ramadorai
Robert Cornelius Rassa
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Mohamad A.H. Sawan
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Yakov Shirman
Dariush Shirmohammadi
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Melvin W. Siegel
Michael Bernard Silevitch
Gurindar Singh Sohi
Alfred Spector
Jaideep Srivastava
Daniel Dean Stancil
Paul Gregory Steffes
Allan Otto Steinhardt
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Norobu Sugamura
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Christer M. Svensson
Wim Sweldens
Arnold Lee Swindlehurst
Wojciech M. Szpankowski
Toshi Takamori
Tieniu Tan
Yuan Yan Tang
Kazuo Tanie
David L. Tennenhouse
Stuart K. Tewksbury
Osamu Tomisawa
Josep Torrellas
Frederick Nicholas Trofimenkoff
Ismail Burhan Turksen
Ifeanyi Charles Ume
Vadim I. Utkin
Yozo Utsumi
Douglas Peter Verret
Randall H. Victora
Michael Waidner
Joel Forbes Walker
H. Bruce Wallace
Steven J. Wallach
DeLiang Wang
Fei-Yue Wang
Yao Wang
Daniel Ward
Mark Wegman
Wu-Tsung Weng
Jay Martin Wiesenfeld
Thomas Turner Wilheit
Jay Williams
Alan Willner
Moe Z. Win
Andrew K.C. Wong
David Wood
Dwight L. Woolard
Gregory Wornell
Cheng-Wen Wu
Shin-Tson Wu
Longya Xu
Seiichi Yamamoto
Binboga Siddik Yarman
Daniel So Yeung
Katsumi Yoshino
Ken-ichi Yukimatsu
Hong-Jiang Zhang
Zhen Zhang
Yilin Zhao
Marvin Carl Ziskin
Albert Y. Zomaya

Engineering a Lively Newsletter

BY CAROL GOODALE

CREATING AN INFORMATIVE IEEE newsletter that's of value to members is easier said than done. You have to focus on your readers' needs, get them involved in submitting news items and articles, and publish in a timely fashion. And it can't hurt to use a bit of humor wherever possible.

Harry McDonald is the editor of the IEEE Region 10 newsletter, posted online for the 60 000 members who live in Asia and the Pacific Rim. The newsletter is a mix of articles written by McDonald and other members, and McDonald works hard at casting a wide net to get as many contributions from across the region as possible.

"We issue calls to Region 10 executive committee members and to section chairs for news items," he says. "This approach requires an extra step in their efforts but being one of our authors is a good way for section chairs to strengthen their contacts with members." To be assured of a supply of articles, McDonald is developing a network of contributing editors throughout the region.

"When encouraging submissions from guest writers, you can ask for articles to be short and snappy," he says. "But editors will learn that they have to be flexible in their expectations."

Be prepared to accept whatever articles are sent. Then "use whatever editorial style you have to get the items shorter and more interesting," he says.

FOCUS ON READERS' NEEDS Region 7 newsletter editor Abhigyan Gupta considers the technology needs of many of his 14 000 Canadian members. "I keep the length of the newsletter reasonable so dial-up users don't have to wait too long to download," he says.

In the past year, Gupta began distributing his newsletter [shown above] using the IEEE Regional Activities e-Notice service. This electronic newsletter subscription service, piloted in 2003, helps IEEE organizational units to distribute their newsletters and meeting notices by e-mail.

Interest by members in contributing to the newsletter has been growing, says Gupta. "It took a while to get members to submit content about local activities, but then we hit a positive feedback loop where more regional content brought more interest in having local content, too," he says.

An active IEEE volunteer since his first days as a student member, Gupta was surprised when he was asked to edit the newsletter.

"Many of us don't think we have the skills in communication," he says. His role as editor piqued his interest in learning to write more effectively. "It is more and more important to be able to communicate what you are thinking and to persuade others of your ideas."

TRY GAMES AND HUMOR Butch Shadwell also sees honing one's writing skills as a key to success. He is president of Shadwell Technical Services, a consulting firm in Jacksonville, Fla., USA. For the past 12 years, Shadwell has written a monthly column, the "Brain Teaser Challenge," for the IEEE Florida-West Coast Section newsletter.

"I started including humor to make the material more palatable," he says. He also advises writers and editors to work on their vocabulary and literary style. "A little alliteration can go a long way, and so can imaginative word usage," he says. "The written word is an art form of its own."

Shadwell's columns are now published in a variety of international publications, and other IEEE editors can reprint them.

A successful newsletter also demands strong editorial management skills, points out Robert Smrek, director of production services for IEEE Periodicals at the IEEE Operations Center in Piscataway, N.J., which provides printing and mailing services, as well as PDF postings, for 19 society newsletters.

"It's not an easy job to be a volunteer editor, so organization is key," Smrek says. "You need to stay on top of contributors to meet deadlines."

Meeting production deadlines will result in a consistent publication schedule, and your readers will know when to expect your newsletter. Publish late and you could be involved with scheduling problems at your printer. And then your newsletter could be delayed in delivery, especially for those mailed to other countries. Reaching your readers late could eventually undermine a newsletter's success, Smrek says.

POSTING ONLINE Many editors avoid delays caused by the postal system by posting their newsletters online. Luis Remez, editor of the IEEE Argentina Section's online newsletter, provides news to 4500 readers. He says that not only does he get the information out more quickly, but he also saves on printing and mailing costs.

Getting a newsletter out in a timely fashion brings other advantages as well. It makes it easier to coordinate events around the section. It also improves connections with members and makes it easier to share and retrieve information. A "Contact Us" link that Remez has put on his site often yields information of interest to the section's members he can include in his newsletter.

The newsletter also is a way to consolidate activities among the section's members, and not duplicate events. "We place great importance on operating in an integrated way," he says. "Judging by the increased number of responses we receive to activities [we write about], the newsletter is succeeding in reaching members."

FOR MORE INFORMATION

Tips for producing a successful newsletter are available at the online Section-Chapter Volunteer Forum at http://www.ieeecommunities.org/sectionchapter_vol.

Guidelines for creating and submitting newsletter materials to IEEE Periodicals are listed at http://www.ieee.org/organizations/pubs/magazines/index.html.

The e-Notice is located at http://www.ieee.org/organizations/vols/e-notice.

To contact Butch Shadwell, e-mail him at b.shadwell@ieee.org.

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