IEEE

ATTRACTING FEMALE ENGINEERS p. 14

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Standards for Car Talk

BY IVAN BERGER

The more your car knows, the safer you—and everyone around you—will be, or so goes the thinking.

The network linking a car's major systems—engine, transmission, brakes, suspension, and so on—already does many things. It helps cars correct skids before they happen, brake better, avoid tailgating, warn of unsafe lane changes, hold you securely in place in a collision, and call for assistance if you crash. Someday soon, cars will network to other cars and roadside data systems to spread the word about congestion, road conditions, and accidents. And they'll access travel-related Internet services.

A new family of four IEEE standards is bringing that day closer, by ensuring that car and roadside infrastructures can communicate with each other. These standards could do for cars and vehicular transportation what the popular IEEE 802.11 wireless standards have done for laptops and networking.

The IEEE 1609 suite of WAVE Communications standards, developed for the U.S. Department of Transportation (DOT), covers the underlying architecture for WAVE (Wireless Access in Vehicular Environments). The WAVE protocol uses the dedicated short-range communications band, at 5.9 gigahertz. Three of the standards in the suite have been approved for trial use, and one is pending.

The first, IEEE Std. 1609.2, approved in June, covers methods of securing WAVE messages against eavesdropping, spoofing, and other attacks. The second, IEEE Std. 1609.1, released in October, deals with managing multiple simultaneous data streams, memory, and other system resources. The third, IEEE Std. 1609.4, approved in November, primarily covers how multiple channels—including control and service channels—should operate.

IEEE Std. 1609.3, which covers WAVE networking services and protocols, and is an extension (802.11p) to the IEEE 802.11 wireless networking standard covering WAVE-mode transmission, is under development.

The Intelligent Transportation System Committee of IEEE's Vehicular Technology Society is the sponsor of the WAVE standards. Funding comes from the DOT, and the Federal Communications Commission has allocated a 75-megahertz swath of the 5.9-GHz band for WAVE.

WHY WAVE? The WAVE system, once in place, would be designed to make driving safer and easier. Several times each second, WAVE-equipped cars will transmit information to other cars and to roadside transceivers about their location, speed, acceleration or deceleration, brake status, windshield wiper operation, and more. Such information is already circulating within cars equipped with GPS, electronic speedometers, antilock brakes, and other sensor-based systems.

The roadside transceivers could eventually be installed at every traffic light and freeway interchange along major roads, "and anywhere there have been lots of accidents," says IEEE Member Lee Armstrong, who is the editor of IEEE Stds. 1609.1, .3, and .4. The roadside units will share information with passing vehicles and with safety, highway, and traffic-control authorities.

To monitor traffic [Continued on page 6]

Getting Automation Some Respect

BY TRUDY E. BELL

MANY PEOPLE HEARING the word "automation" picture robots assembling cars in a factory. But an IEEE quarterly journal has, since its introduction almost three years ago, been making every effort to establish automation as a science in its own right and a field separate from the robotics in manufacturing plants. The journal, *Transactions on Automation Science and Engineering* (*T-ASE*), is out to give automation greater visibility—and credibility. And preliminary readership figures indicate that it is succeeding.

DYNAMIC DUO Automation and robotics have often been confused, notes IEEE Fellow Peter B. Luh, professor of electrical engineering at the University of Connecticut at Storrs. Research in robotics today deals mainly with applying intelligent systems to explore the unknown, be it on the ocean floor or on a far-off planet. Because scientists don't know what will be encountered, robots must be flexible when it comes to the [Continued on page 8]

Drug companies apply automation techniques to parts-feeding mechanisms.

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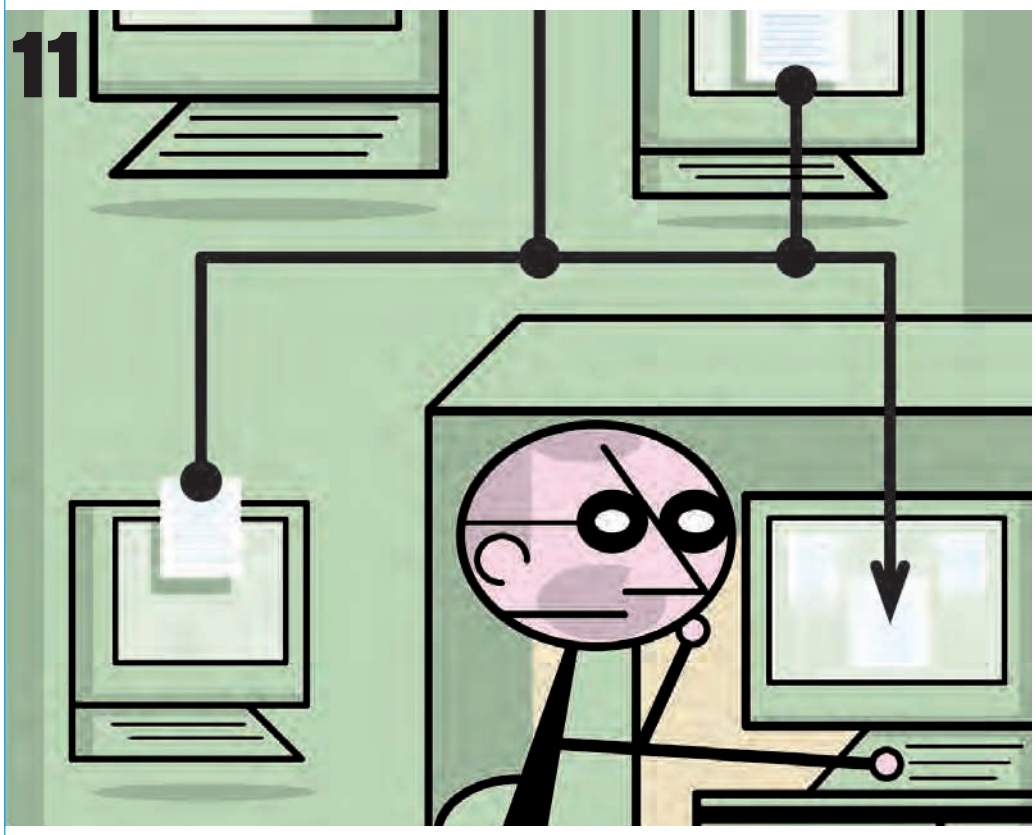

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LOOK FOR THESE ARTICLES ON 7 MARCH:

FEATURE Members of the IEEE Pune Subsection in India take on the task of improving the country's environment through an awareness drive.

NEWS Find out who are the five new members of the IEEE Board of Directors.

FEATURED CONFERENCE Learn about the latest optics and photonics research at the Conference on Lasers and Electro-Optics/Quantum Electronics and Laser Science Conference to be held from 8 to 10 May in Baltimore.

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NEWS

FROM AROUND THE IEEE & THE WORLD

Left to right: Pedro Ray, John Vig, and Marc Apter

Board Names Three For 2008 President-Elect

THE CANDIDATES FOR 2008 IEEE President-Elect are Marc Apter, Pedro Ray, and John Vig. The IEEE Board of Directors nominated them at its November meeting, and the three men will face off during the next annual election.

The winner serves as 2009 IEEE President, succeeding 2008 President Lewis Terman.

Apter, an IEEE senior member, retired in 2000 after 36 years with the Naval Sea Systems Command, in Washington, D.C. For six years before he retired, he was the command information systems security manager and head of the Information Technology Operations and Maintenance Branch. He is currently a senior information assurance specialist with EG&G Technical Services, a subsidiary of URS Corp., in San Francisco.

Apter was IEEE vice president, Regional Activities, in 2004 and 2005, and served as director of Region 2 (Eastern United States) in 2001 and 2002.

Ray, a senior member, is chief executive of Ray Engineers, one of the largest architectural design firms in Puerto Rico. He also owns Magdalena 1212 (a builder of luxury, high-rise condominiums) and River Stone Development (which erects office buildings).

This is Ray's second year as Regional Activities vice president. He also was IEEE treasurer in 2003 and 2004, and director of Region 9 (Latin America) in 2000 and 2001.

Vig, an IEEE Fellow, retired in February 2006 after 36 years as an electronics engineer leading R&D programs at the U.S. Army Communications and Electronics Research, Development, and Engineering Center, in Fort Monmouth, N.J. He now is a technical consultant to Systems Planning Corp., in Arlington, Va., and also serves on the technical advisory board of SiTime Corp., a Silicon Valley startup.

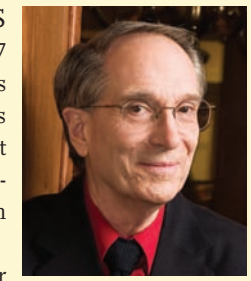
Vig founded the IEEE Sensors Council, of which he was president in 2000 and 2001. In 2002 and 2003, he was director of Division IX and a member of the IEEE Board of Directors, and in 2005 he was IEEE vice president, Technical Activities. A candidate for 2007 President-Elect, Vig lost that election to Lewis Terman.

Correction

In "Tom Bartlett Receives First Herz Staff Award" [December, p. 4], the name of Bartlett's wife, who is deceased, should have been given as Elaine.

Also, the IEEE Board of Directors, at its November 2006 meeting, made the IEEE Eric Herz Outstanding Staff Member Award [p. 4] an annual recognition.

Voters Choose Lewis Terman As 2007 President-Elect



LIFE FELLOW LEWIS Terman was chosen the 2007 IEEE President-Elect this past November. He begins his term as IEEE President on 1 January 2008, succeeding current President Leah H. Jamieson.

In Terman's 45-year career at IBM Research, he served as a researcher, a manager, and associate director of the systems department before retiring in January 2006. He worked on solid-state circuits and memory technology, digital and analog circuits, and processor design.

Terman has been a member of the IEEE Board of Directors for three of the last five years and was president of the IEEE Electron Devices and Solid-State Circuits societies.

Of the IEEE members who turned in valid ballots last year, 20 656 selected Terman, while 16 337 chose his opponent, IEEE Fellow John Vig.

Thomas Kailath Awarded IEEE Medal of Honor

IEEE LIFE FELLOW Thomas Kailath is the recipient of the 2007 IEEE Medal of Honor for his development of powerful algorithms in the fields of communications, computing, control, and signal processing.

A professor emeritus of electrical engineering at Stanford University, in California, Kailath is regarded as an engineering Renaissance man. As J.F. Gibbons, former Stanford dean of engineering, said, "His career has been an extraordinary success many times over, and for a different set of reasons each decade." Indeed, the focus of Kailath's research and teaching was information theory and communications in the 1960s; linear systems, estimation, and control in the 1970s; very large-scale integration design and sensor-array signal processing in the 1980s; and applications to semiconductor manufacturing and digital communications in the 1990s. Meanwhile, he has also made important contributions to stochastic processes, operator theory, and linear algebra. And he has co-founded several successful high-tech companies.

In 1961 he became MIT's first student from India to earn a doctorate in electrical engineering. He taught at Stanford for more than 40 years.

Kailath is scheduled to receive the Medal of Honor on 16 June at the Loews Hotel in Philadelphia. The award is sponsored by the IEEE Foundation.

Three Share Education Prize

2004 IEEE PRESIDENT and Life Fellow Arthur Winston has been named co-recipient of the Bernard M. Gordon Prize—one of the engineering profession's highest honors, given annually by the U.S. National Academy of Engineering. The academy selected Winston, along with IEEE Life Fellow Harold S. Goldberg and Member Jerome E. Levy, and Tufts Gordon Institute, in Medford, Mass., to share the US $500 000 prize. Neither the institute nor Tufts had a role in choosing this year's Gordon Prize recipients.


Arthur Winston

The three were to receive the award, which recognizes innovation in engineering and technology education, on 20 February at Union Station in Washington, D.C.

Winston, Goldberg, and Levy were recognized for their "multidisciplinary graduate program for engineering professionals who have the potential and the desire to be engineering leaders."

The three created the master of science program in engineering management offered at the Gordon Institute, established in 1984 in Wakefield, Mass. The institute joined Tufts University in 1992 and is now part of its School of Engineering.

The master's program teaches project management and communication skills, product innovation and development, and leadership.

—News compiled by Anna Bogdanowicz & Jason Laday

MARKETPLACE OF IDEAS

RESPONSES TO DECEMBER'S QUESTION

Big Brother in the Sky

Developers working on a project called Security of Aircraft in the Future European Environment claim new on-board technology will be foolproof against hijackers. The system uses sensors, cameras, and microphones to monitor passengers' behavior. In an emergency, an autopilot would automatically be activated to land the plane safely.

Is the increased safety worth being so strictly monitored and giving up so much of your privacy?

Secure Service

Having spent the better part of the past decade as a technologist working with airline industry "passenger service" managers, I took up the saying "There's no passenger service without security." The best meals, friendliest cabin crew, and most comfortable seats cannot compensate for less-than-maximum security and safety.

I only hope the Security of Aircraft in the Future European Environment program expands to worldwide use and truly is a multitiered program. It should include speech stress recognition and language translation/interpretation algorithms, as well as real-time secure connectivity to threat databases, with key information disseminated to crew and in-flight law enforcement personnel.

Giving up what privacy? Give me the ultimate passenger service—use every technology and tool available to keep us safe!

ANTHONY "BUZZ" CERINO
Bedminster, Pa.

Surrounded by Strangers

There is nothing I do on a plane that requires any level of privacy that could be exploited to endanger my fellow passengers. If, however, I needed to do something privately, such as work on secure documents on behalf of my company's business, why would I ever consider doing that in the middle of a bunch of strangers on a plane?

STEVEN KNUDSEN
Bragg Creek, Alta., Canada

How Foolproof?

Your question is based on a false premise: open cabins and personal recording equipment eliminate the aural and visual privacy of all commercial airline passengers. Instead, it's worth asking whether such a system can ever be foolproof, or whether the risk reduction achievable with current technology is worth the cost.

MARTIN SCHULMAN
Herndon, Va.

No Privacy in Public

Common sense—not to mention a U.S. Supreme Court decision that says you have no reasonable right of privacy when in public venues, such as on the street, in public conveyances (buses, trains, and planes), or in public buildings—makes your question moot. The monitoring of behavior in any public place must be accepted. However, I will fight to the death for the right to privacy inside my home or automobile, as well as privacy behind a closed stall door, even in a public restroom.

FRED E. PIERING
Maitland, Fla.

Balancing Act

Security on aircraft is certainly a critical concern these days. Some people may be sensitive about sharing their personal data; however, a responsible government is duty-bound to guard its citizens from attack.

But security relies on technology. And technology can be used to track people's activities without their consent—which might be considered an invasion of privacy. Therefore, government must explain why it intends to deploy such technology. Also, legislation should limit the use of personal data for safety purposes. Safety and privacy are not the same, and it's important to ensure that they are both handled properly.

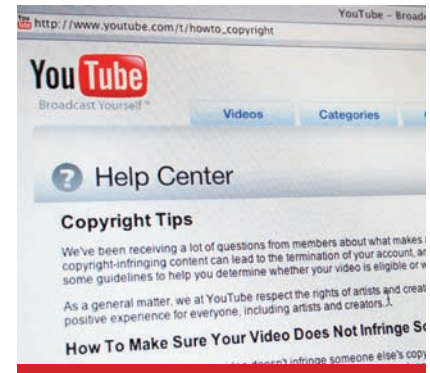
HONG-LOK LI
Vancouver, B.C., Canada

Fools on Parade

Instead of answering whether we'd be willing to trade privacy for security in the case of automated surveillance systems on aircraft, perhaps we'd be better off asking whether we actually believe the government can implement such foolproof systems.

Would we be trading privacy for security, or privacy for extremely expensive incompetence? My bet is on the latter; so-called foolproof systems are no match for the new and improved fools constantly coming out of Washington, D.C.

ROBERT PERRY
Chaska, Minn.



THIS MONTH'S QUESTION

Will a Toned-Down YouTube Tank?

YouTube, the video-sharing Web site owned by Google, became popular by allowing users to upload almost any video, but that may soon change. YouTube has promised to use antipiracy software to track down and remove content that violates copyright law. Critics say taking down that content will lead to the Web site's demise because YouTube thrives on the free sharing of popular copyrighted TV shows and movie clips.

How do you think the antipiracy crackdown will affect the popularity of YouTube?

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. Responses will appear in the June issue of *The Institute* and may be edited for brevity. Suggestions for questions are welcome.

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LETTERS

All Things (Not) Considered

About "Spam Filtering, Anyone?" [December, p. 10], perhaps I did not read the fine print, but when the filtering service was introduced, I thought it was to be applied to all aliases by default. That is why I never signed up for the filtering service. This misconception was not considered in the article as a possible reason for members not taking advantage of the service.

GREGORY T. SAMUEL
Fairfax, Va.

Robert V. Jones, staff director for IEEE Information Technology Infrastructure and Operations, responds: To comply with a recommendation made at the 2002 IEEE Sections Congress, the IEEE Unsolicited Commercial E-mail Filtering Service was not applied to all IEEE e-mail aliases. The recommendation called for an opt-in arrangement to allow members to choose their own level of spam filtering and not leave it to the IEEE. Questions about the IEEE UCE Filtering Service should be directed to uce-admin@ieee.org.

Working Group Suggestions

Regarding "Standards Uproar Leads to Working Group Overhaul" [December, p. 1], the IEEE Standards Association should be commended for taking action, although it apparently took a while to do so.

I'm sure that this problem [of working group members not voting as individuals, but instead representing their companies' interests] has occurred in the past, and more steps are needed to avoid it in the future.

First, I suggest a committee chair be chosen who is not associated with the technology of the particular standard or the companies represented.

Second, I don't think it's fair to allow representatives of the same employer to have more than one independent vote. I suggest that "approval votes" should be limited to one per company, regardless of the number of representatives on the committee.

Third, in the future the ethical issues related to this problem should be addressed, even leading to the loss of IEEE membership and its privileges for the worst violators.

LeEARL BRYANT
Richardson, Texas
Senior Member LeEarl Bryant was the 2002 IEEE-USA President

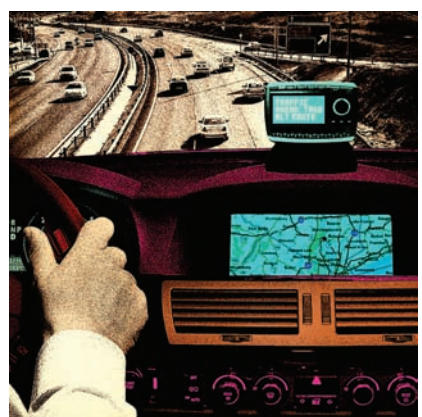
STANDARDS from page 1

better, vehicles with WAVE could double as traffic reporters. They'll also sense ambient temperature and road conditions, enabling highway authorities to deploy snowplows, for example, even before they're needed. And the roadside units could warn drivers away from hazards and congestion. "You'll also be alerted when a traffic light's about to change, and be warned if someone's running through it," Armstrong says.

None of the information coming from cars will identify the vehicle it comes from. "We're building privacy in, from the ground up," says IEEE Member Doug Kavner, who chaired the security subgroup for IEEE Std. 1609.2. To mask their points of origin, for example, WAVE-equipped cars will transmit only limited data until they've traveled a certain distance from their starting points, Kavner says. For even more privacy, WAVE radios will change their local Internet Protocol (IP) and medium access control addresses periodically.

Drivers will receive information about road conditions, red lights, and hazards from cars 300 to 500 meters ahead on highways, and 100 meters ahead in cities. Emergency vehicles, equipped with longer-range (1-kilometer) WAVE systems, will be able to warn vehicles ahead to let them pass and to control traffic lights to give them the right of way.

Vehicle manufacturers must decide how to use WAVE data, how to present the data to drivers, and what automotive systems to control. The emphasis will be on driver alerts, including visual, audible, and tactile warnings. A warning of an impending accident will be fed to pre-crash systems, such as those now found on some luxury cars. These systems do such things as pre-tension seat belts, prepare brakes for an emergency stop, and tilt reclined seats upright.



A WAVE radio could alert the driver to traffic and other road conditions.

NATIONWIDE Once widely adopted, the WAVE infrastructure could provide a single, nationwide system for paying tolls, time-of-day road charges, and other usage fees. It might also be used to pay for gas and parking, though the DOT does not currently contemplate doing that. Like today's piecemeal toll-tag and credit-card systems, such uses could compromise driver privacy and will be switched on only in cars whose drivers opt for them. Data on traffic and road conditions, however, will be sent automatically and anonymously.

More intrusive uses, such as tracking cars that speed or ignore stop signs and traffic lights, probably would not be allowed in the United States, both for privacy's sake and lest they discourage car owners from adopting the system.

The auto industry, the IEEE, and the DOT hope their cooperation will ensure that when vehicles with WAVE roll off the assembly line, "there will be infrastructure to communicate with," a DOT representative says. Even so, the road infrastructure might lag behind WAVE installations in cars, because responsibility for roads is spread among the states and countless local traffic, transit, and safety authorities.

"Who will pay and who will orchestrate is under discussion," says Kavner, the security subgroup chair, "though it seems safe to assume that there will be federal involvement and funding."

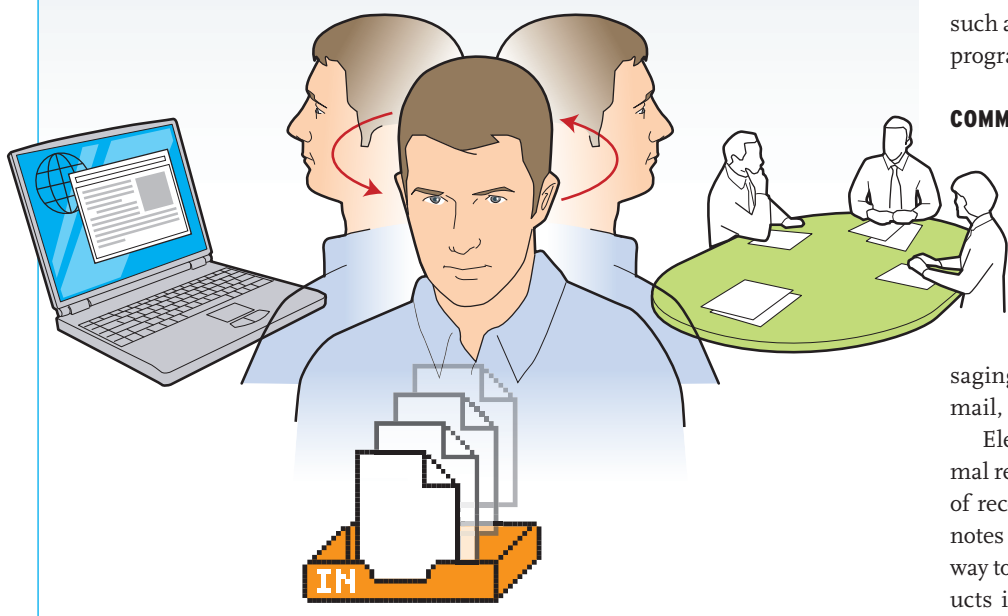
HOW FAR OFF? Highway tests of the WAVE system are scheduled to begin soon. Electronics manufacturers are prototyping WAVE radios, and the auto industry, which has been involved with the technology for several years, is developing ways to build the radios and their antennas into cars. The government and the auto industry are expected to decide whether to implement the system by the end of next year. Cars with WAVE may come off the assembly line in about 2011.

Tests so far have uncovered no technical problems. WAVE is built on existing technologies, such as the IEEE 802.11 chipset and an adaptation of IP version 6. However, the new standards are for trial use and may well need revision before they are permanently adopted.

First, of course, the system has to work, Kavner notes. "No decisions have been made about deployment, and no one has deployment in their current budget," he says. "But the DOT, the auto industry, and other groups are pouring a lot of effort and money into WAVE. They really want to make it happen."

HOW TODAY'S TECHIES WORK

BY KATHY KOWALENKO



Do you match the profile of today's typical high-tech worker? You do if e-mail is your main way of communicating, you spend half your day in meetings, and you search the Internet for the latest research instead of reading print journals.

That's according to a study of how engineers work, commissioned by the IEEE Publication Services & Products Board. The study was carried out at some of the most innovative technology companies in the United States and India. The hope was to learn how to design new products and services for high-tech workers.

"We wanted to learn how the IEEE might target its products to specific age groups," says Saifur Rahman, 2006 vice president, IEEE Publication Services & Products. "But before we could target them, we had to know how they worked and what their needs were, and the study was designed to find that out."

A total of 103 engineers and technical professionals from four U.S. and two Indian multinational companies in the IT consulting, medical device, and telecommunications industries were studied. The workers were involved with software and hardware design, testing, product development, and managing workgroups. They were observed for more than 590 hours by a research team from the University of Tennessee School of Information Sciences, in Knoxville. The researchers watched the engineers as they worked alone or participated in meetings, and interviewed them.

Carol Tenopir, Suzie Allard, and Kenneth Levine were the lead investigators. Tenopir, a professor of information sciences, oversaw the study. Allard, an assistant professor of information sciences, and Levine, an assistant professor of communication studies, observed the U.S. workers in the summer of 2005. Allard studied the workers in India in December 2005. The complete study's results were released in November.

The project was unusual because the behavior of high-tech engineers doing cutting-edge work has rarely been studied, according to Tenopir. "These are not the kind of people who respond to questionnaires," she says. "It's uncommon to get such level of detail with this many subjects, and to get it across countries. This magnitude is unusual for engineers in the workplace."

The engineers' work was broken down into two types of activities, or events: communication and information gathering. Communication events included phone conversations, face-to-face or group meetings, writing reports, and handling e-mail, instant messages, and pages. Information-gathering events consisted of searching the Internet, using software such as word processing and spreadsheet programs, and reading publications.

COMMUNICATION IS KEY It was found that more than half an engineer's workday is spent communicating, mostly with co-workers. E-mail is the most frequently used method, more in the United States than in India. Phones are still popular, and instant messaging is on the rise. Faxes, interoffice mail, and postal mail are rarely used.

Electronic messages, instead of formal reports, have become the "document of record" for design processes. Tenopir notes that workers save their e-mail as a way to archive their decisions about products in development and to track problems with existing products.

Face-to-face communication still has its place, the study demonstrated. For quick answers to a question or help with finding an expert, engineers turn first to their colleagues and next to their company's repository of information.

"They are so above the curve that nothing outside their organization is useful," Tenopir says.

ONLINE UPDATE About a quarter of an engineer's day is spent at some type of information event. Software for such tasks as word processing, computer-aided design, and Web browsing is heavily used.

The study found that high-tech workers are not likely to depend on traditionally published research. In fact, engineers at five of the six companies studied rarely look to printed journals, books, or articles for research results. Instead, it was observed, they rely on the Internet, believing that journals and conference proceedings they find online are more up to date. They want research to be shared quickly, and they say search engines such as Google Scholar can get them the most current documents posted online. Also of great interest is industry-related news, information valued by many of the engineers.

"They feel the pressure to stay ahead, and when they're looking at sources to help them, they don't use what you would consider traditional methods," Tenopir says. "Standard printed publications are not as relevant to them, because they are very concerned about current information."

But engineers in India still have an "incredibly high regard for IEEE journal articles, especially those published at conferences," Allard notes.

TIME WASTERS Meetings have become the bane of engineers, taking up about half their day. Meetings run slightly longer in the United States than in India. An average U.S. meeting lasts about 55 minutes, compared with about 47 minutes in India. And more people show up at U.S. meetings than in India: about eight people versus five. That's because U.S. companies will pull in an entire work team, while Indian companies invite a more targeted group, Allard says.

In any case, it's often not time well spent. "U.S. companies waste a lot of time in meetings," Tenopir says. "They're too structured, too top-down, and people already have the information given at the meeting because it had been shared beforehand in attachments that came with the meeting notice."

Trying to keep up with their heavy workload, attendees often multitask during meetings—writing and reading e-mail, surfing the Internet, or even doing their regular work. That happens more in the United States than in India: multitasking occurred in 46 percent of U.S. meetings, compared with 20 percent of the meetings in India.

LESSONS LEARNED Rahman says the results have given the IEEE several ideas for new publications, especially for design engineers. But the data also show that the IEEE needs to do a better job of promoting its existing products, such as conference proceedings and the IEEE Xplore digital library. He notes that conference proceedings have timely and peer-reviewed papers that are not as old as the information found in journals. Also, Google Scholar often takes users to information that is older than papers that members could get directly from IEEE Xplore, because the IEEE does not release its newest material to Google.

AUTOMATION from page 1

tasks they can perform. Certainly, the accomplishments of the Mars rovers *Spirit* and *Opportunity* publicized in the general press indicate that robotics gets more glamorous chores than automation, as well as more media attention and, perhaps because of this exposure, the lion's share of research funds.

Automation research, in contrast, tackles predetermined tasks, devising systems that repeat a process over and over. Principal concerns are not with the unknown but with speed, precision, efficiency, reliability, quality, and cost-effectiveness. Yes, automation may be incorporated into robotic systems, "but when it works well, you don't see it," Luh says. "That very invisibility hampers research, because automation 'gets no respect,' to quote comedian Rodney Dangerfield, and it's hard to attract the best minds here." This is so "even though many fundamental scientific and practical questions about automation are still unanswered," he adds.

To lift automation out of the shadow of robotics and address its unique issues—especially the need to set fundamental automation theory on a sounder footing—the IEEE's Robotics and Automation Society launched its new journal in June 2004. Actually, the RAS split its journal, *IEEE Transactions on Robotics and Automation* (*T-RA*), into two publications: *T-ASE* and *IEEE Transactions on Robotics* (*T-RO*).

ATTRACTING ATTENTION "Our goal was to establish *T-ASE* as the most-cited journal devoted to automation by publishing original, significant, and visionary papers describing new theory and applications," says Luh, the journal's editor in chief.

Preliminary numbers of IEEE Xplore's digital library downloads per paper already indicate that research reported in *T-ASE* is as sought after as that of other IEEE journals in Xplore that were also launched around 2004. (When this article went to press in February, relevant citation figures were not available. The index used by academic journals to ascertain their importance in a field, tallying what papers from 2004 and 2005 were cited in papers published in 2006—*Journal Citation Reports*, published annually by Thomson Scientific—had not yet been published for 2006.)

T-ASE is also trying to attract attention from the news media. In November, IEEE Fellow Kenneth Y. Goldberg, who chairs the journal's advisory board, did a radio and podcast interview called "Automating the World" on the CBS News Radio Network. Goldberg, a professor of industrial engineering at the University of California at Berkeley, discussed the challenges the field faces and some of the advances that the journal has covered.

"When an IEEE journal is founded, it tends to legitimize a field and crystallize a new research area," Goldberg says. That's exactly what happened with robotics two decades earlier with the founding of *T-RA*. He says he hopes the same will happen with *T-ASE*, especially for encouraging research on the fundamental theories and principles behind automation.

MAJOR CHALLENGE One example of a major unsolved fundamental challenge in automation is parts feeding. If an automated assembly machine is fed a box of randomly oriented parts—brackets, for example—how can it consistently insert each piece into an assembly coming down a production line? Parts feeding is also an issue in the pharmaceutical industry, where one concern is how to funnel millions of pills into hundreds of thousands of tiny bottles without damaging the tablets.

Most factories now solve the parts-feeding problem with custom-built machines. "There's a whole cottage industry of gurus who devise custom solutions for specific parts," Goldberg says.

More useful, however, would be a general algorithm that takes a digital model of the part and, without human intervention, develops the specifications for an interface that would orient and feed the parts to the assembly machine. But that requires uncovering mathematical principles for analyzing the geometry, friction, and kinematics of parts of any shape and then figuring out how to get them all to fall in just one orientation. That is the type of fundamental challenge the *T-ASE* editors are encouraging journal authors to address.

NOT THE FACTORY ALONE Another goal of Luh, Goldberg, and other leaders of the Robotics and Automation Society is to do away with the perception that automation is used only in factories. Automation is also fundamental to monitoring systems (for home and office security and environmental safety), speech recognition (think of directory assistance for telephone numbers), and the task of running hundreds of standard but complex chemical tests to discover new pharmaceutical products. In short, "automation is everywhere," Goldberg points out.

To home in on these diverse applications, articles in *T-ASE* have explored new fields. Automating the cultivation of biological cells and the analysis of human DNA was covered in a special issue in April 2006, "Automation for the Life Sciences." The July 2006 special issue, "Nanoscale Automation and Assembly," addressed pressing questions about manipulating nanoscale materials by various means, including developing nano-size servomotors and sensors.

Special issues slated for this year and next include one on systems for automating the home and another dedicated to drug delivery—that is, automating the processes by which medication is released into the body.

FOR MORE INFORMATION about *Transactions on Automation Science and Engineering* (*T-ASE*) and the upcoming Conference on Automation Science and Engineering from 22 to 25 September, visit http://www.ieee.org/t-ase.

Goldberg developed an algorithm for rotating any two-dimensional shape into a consistent orientation. Give it a try using an interactive Java applet he has put at http://goldberg.berkeley.edu/part-feeder.

WHERE THE MONEY GOES

IEEE SENIOR MEMBER Robert Herrick recently wrote to *The Institute* to ask about the IEEE's income and expenses. A good question, we thought, and something that all members should know about.

According to the 2005 IEEE Annual Report, the most recent report available, the IEEE had revenue that year of US $297.1 million and expenses of almost $267.0 million. A breakdown of revenues and expenses by the IEEE's primary lines of operations is shown below.

The IEEE had a strong year financially in 2005, with a surplus of $30.1 million; 2006 will also prove to be a good year, according to Senior Member Joseph Lillie, the 2005 and 2006 IEEE treasurer. He points out that at the end of 2005, the IEEE had net assets, including its land and buildings, of approximately $168.7 million.

"The IEEE is in excellent shape financially in contrast to five years ago, when the investment market impacted performance," Lillie told *The Institute*. "Back then, we were investing significantly in our business and counting on investment gains to cover the costs; the money we had in reserve was dwindling.

"A lot has changed since then," he adds. "The investment market improved, and the IEEE made changes to its business practices. Now we are growing operationally, and accordingly, the reserves are growing. We adjusted to the conditions, and we are now positioned financially for the long term to ensure that we can offset any investment market downturn." The complete annual report can be found in the About Us section at http://www.ieee.org.

—*Kathy Kowalenko*

2005 REVENUE

Membership (and programs that support the IEEE's mission)	$ 59 069 700
Periodical sales (including related advertising)	101 815 700
Conferences (fees and sales of conference proceedings)	106 580 100
Standards	16 092 800
Investment income	12 490 500
Other income	1 062 100
TOTAL REVENUE	**$ 297 110 900**

2005 EXPENSES

PROGRAM SERVICES	
Membership (support and related programs)	$60 250 400
Periodicals	91 906 600
Conferences	92 831 400
Standards	13 185 200
Total Program Services	**$ 258 173 600**
General and administrative	8 801 600
Total Expenses	**$266 975 200**
CHANGE IN NET ASSETS (SURPLUS)	**$ 30 135 700**

Improving the Public's Awareness of Engineering

The close of the 20th century was a natural time to look back on the accomplishments of the previous 100 years.

One such retrospective, compiled by the U.S. National Academy of Engineering, enumerated the 20 greatest engineering achievements of the century, and IEEE fields are front and center.

Electrification tops the list, followed by the automobile, the airplane, safe abundant water, electronics, radio and television, the mechanization of agriculture, computers, the telephone, air conditioning and refrigeration, highways, space exploration, the Internet, imaging technologies, household appliances, health technologies, petroleum and gas technologies, laser and fiber optics, nuclear technologies, and high-performance materials. Around the globe, lives are fundamentally different because of our technologies.

We have every expectation that the same will hold true for this century. Early front-runners for expected impact include nanotechnology, alternative energy, telemedicine, and quantum computing, but the end-of-century list will almost certainly contain technologies as unimaginable today as the Internet was in the year 1907.

With engineering playing a role in eveyone's life, it is natural to ask this question: Does every person on the planet—the "general public"—need to know what engineers do and how we benefit society? Almost certainly not, but I believe there are many segments of "publics" within the general population whose awareness of what we do—and have done—can benefit our profession and increase the impact of our work.

For example, if governmental decision-makers understand technologies such as wireless communications, nanotechnology, and developments in energy, they will be better informed when making laws, considering policies, and passing budgets related to standards, safety and health, security and privacy, and science and technology research. Voters armed with an understanding of technologies would have more information to help choose the most knowledgeable leaders. Other crucial publics include educational organizations, teachers, guidance counselors, and parents—who influence who will become the next generations of engineers. In the private sector, senior corporate executives and other industry leaders, as well as investors in new technology endeavors, can have a direct effect on the growth of technologies.

Public awareness also bolsters our profession because when we engineers receive public recognition for our contributions, our sense of pride and accomplishment grows. In turn, this encourages us to continue in the profession and to develop skills needed to advance in our careers.

GREATER VISIBILITY IEEE members tell us our organization could be doing a better job in addressing public awareness of engineering. In 2002, in the last member survey to address the issue, 45 percent of respondents said it is important to promote the engineering profession to the general public. However, only 31 percent were satisfied with how well we are doing in that regard. At the 2005 IEEE Sections Congress, the triennial gathering of IEEE volunteers from across the globe, one of the recommendations was "to find means to increase awareness of the value and expertise that IEEE members add to society, but particularly to their employers."

One of my goals as 2007 IEEE President is to foster programs and activities that promote greater visibility for the IEEE and our profession, not only to employers but also to a wide range of publics.

We have a good start. With programs such as TryEngineering.org (try it!) and the expanding Teacher In-Service Program (http://www.ieee.org/web/education/preuniversity/tispt), we are working to create awareness of engineering and engineering activities among teachers, guidance counselors, and school-age children. In the United States, the IEEE contributes to *Discoveries and Breakthroughs in Science,* brief televised segments about scientific and technological developments, and *Design Squad,* a new public TV program for preuniversity students. IEEE-USA also issues position papers related to U.S. technology policy for legislators and other interested parties.

Other public awareness outreach includes the IEEE Milestones in Electrical Engineering and Computing program, with more than 75 milestones dedicated worldwide so far (http://www.ieee.org/web/aboutus/history_center/about/milestones.html), *IEEE Spectrum* Radio (http://spectrum.ieee.org/radio), and IEEE.tv online programming (http://www.ieee.org/ieeetv). This year will see the launch of "Technology Discourses," which will explore the societal and economic impact of some of our emerging technologies, with activities planned to engage the public (http://www.ieee.org/web/emergingtech/home). The IEEE also has a new program to build stronger relationships with industry around the world, including plans to raise awareness of the IEEE and to identify ways we can work together for the benefit of our members and the profession.

I encourage you to explore opportunities to engage in dialogue with your local publics about what engineers do. You can do this individually or through your section or chapter. The task is demanding because it is not "one size fits all": each audience requires a specific approach. And while you are helping to raise the awareness of engineers and the IEEE in your local area, the potential for professional and personal rewards is enormous.

I welcome your comments on this topic at jamieson.column@ieee.org. ●

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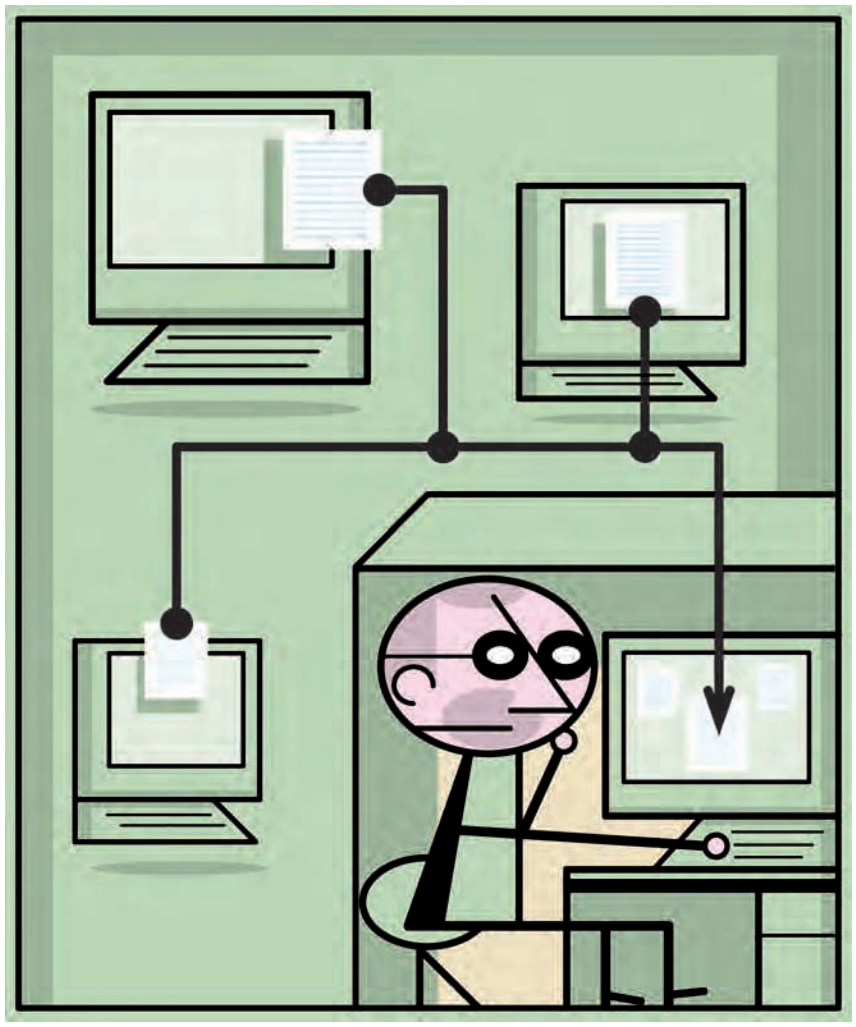


Copy-and-Paste Papers Put Profs On the Offensive

BY ANNA BOGDANOWICZ

More incidents of college students plagiarizing others' work are popping up today than ever before, according to engineering professors queried by *The Institute*. And a recent U.S. survey released by the Center for Academic Integrity of 50 000 undergraduates shows the problem is on the rise. According to the center, 10 percent admitted to plagiarizing in 1999, whereas almost 40 percent said they did so in 2005.

And last year, for example, 21 mechanical engineering graduates from Ohio University, in Athens, were found to have plagiarized their master's and doctoral theses, and others at the school are now under investigation. The problem is growing at universities around the world as well.

Many professors place the blame on the Internet, which has made plagiarizing a simple copy-and-paste process. But there are other reasons for the increase, they say, including a misunderstanding of what plagiarism is. Other factors include differences in how plagiarism is perceived, a lack of basic education in ethics and, to put it simply, the ability to get away with it because professors are too busy to check every paper.

The consequences of growing up with little feel for ethical behavior could be devastating, says IEEE Member Richard Wiltshire, a former part-time lecturer in electrical engineering at Queensland University of Technology, in Brisbane, Australia. "I find plagiarism by engineering students of particular concern because engineers are responsible in many ways for keeping the community safe. If a student has no understanding of proper ethical behavior now, what will that person be like later?" Wiltshire asks.

That's one reason why incidents of plagiarism are being taken seriously. For example, the IEEE has developed a number of sanctions for plagiarists that range from sending a letter of apology to being banned from publishing with the IEEE for up to five years [see "The Plagiarism Problem: Now You Can Help," next page].

REINFORCEMENT One key to stopping plagiarism is to make sure students understand proper attribution. Although most students are taught in high school to cite their sources, that principle needs to be reinforced in college, says IEEE Member Michael Hoffmann, a professor of microwave engineering at the Institute of Microwave Techniques, part of the University of Ulm, in Germany.

"Before students begin to write, I go over our institute's rules of conduct, how to cite a source, and what makes good scientific writing," he says. Students must sign a document stating that they understand the rules. Just telling students their theses will be checked for plagiarism seems to dissuade them from copying, Hoffmann adds.

IEEE Fellow Lloyd "Pete" Morley, who retired in late December from his post as a professor of electrical engineering at the University of Alabama, Tuscaloosa, made sure that his students understood from day one of class what constitutes plagiarism and why it's a serious offense. Students need such reminders because "they may have heard about plagiarism, but not truly understood what it meant," Morley says.

Sometimes students are uncertain when they might be crossing the line. Vikrant Agarwal, an engineering junior at the Pune Institute of Computer Technology, in India, and chair of the school's IEEE student branch, says it's unclear how many words writers can copy before attributing the information to a source. To be safe, Agarwal says, he always cites his sources, even if he's referencing only a few words.

Senior Member Bruce McNair, a professor of electrical and computer engineering at Stevens Institute of Technology, in Hoboken, N.J., sets strict limits. For McNair, using more than four consecutive words or lifting an uncommon phrase may be plagiarizing.

PERCEPTION PROBLEMS That plagiarism is unethical is not universally understood, according to several professors.

In one of Wiltshire's classes, 35 students were copying each other's papers. "They didn't think they were plagiarizing—they thought they were just pulling resources from each other," he says.

And when McNair confronted one of his students with plagiarism, he said the student told him it's an honor for the sources when someone takes their words directly without attribution.

But students at India's Pune Institute, for one, are being taught that copying another's work is unethical. "Plagiarism is a very serious offense at my university," Agarwal says, adding that in serious cases, students receive a failing grade.

Although spotting plagiarism has gotten easier with search engines such as Google and special detection software, professors don't always apply the technology. They rarely run every paper through a plagiarism check because it's so time-consuming, Wiltshire says.

Instead, most look for telltale signs—an inconsistent writing style, say, or a paper that is suspiciously well written—and then either search for the phrases on the Web or use a detection program such as Turnitin. That program checks papers against other student manuscripts submitted through Turnitin, and it also checks the Internet.

At most schools, punishments vary from having students rewrite their paper to, in extreme cases, expelling them. In most cases, students are given a second chance.

Still, some professors say plagiarism has little to do with a lack of understanding. "Students ought to know if they're stealing somebody else's work. I think sometimes it's a temptation because they think it's an easy way out," says Life Senior Member Charles Hickman, an adjunct professor in the electrical and computer engineering department at the University of Alabama at Birmingham.

Others say that in the end it's just a culture of getting away with it. "Students think if they're not caught, then plagiarism is not a bad thing," Hoffmann says.

FOR MORE INFORMATION on the plagiarism survey of students conducted by the Center for Academic Integrity, a consortium of more than 390 institutions affiliated with the Kenan Institute for Ethics at Duke University, in Durham, N.C., visit http://www.academicintegrity.org/cai_research.asp.

The Plagiarism Problem: Now You Can Help

BY ANNA BOGDANOWICZ

Plagiarism is a growing concern for many organizations, including the IEEE. The number of instances reported in IEEE publications has been rising steadily, with 14 in 2004, 26 in 2005, and 47 in 2006.

The Internet is largely to blame for the increase, according to Bill Hagen, the IEEE's intellectual property rights (IPR) manager, in Piscataway, N.J. Digital search engines have made plagiarizing easier because finding information is simpler, and it takes only the swipe of a mouse and a couple of keystrokes to highlight text and paste it into a new document.

AUTHORS TAKE NOTE Plagiarism is defined by the IEEE as the "reuse of someone else's prior ideas, processes, results, or words without explicitly acknowledging the original author and source." To deal with the problem, the IEEE is encouraging members, authors, and publication editors to report cases of plagiarism when they find them. And the IEEE has developed two new online tools that make identifying and reporting plagiarism easier. "Plagiarism can be a bit daunting, so we tried with the new tools to explain it in an engaging way," Hagen says.

The first tool is an animated PowerPoint tutorial that explains the fundamentals of plagiarism, why it is a serious offense, how to avoid it, and how to report it. The second is a flowchart that illustrates the process used to investigate a plagiarism complaint [right].

So why is plagiarism so serious? Besides being a form of copyright infringement and therefore illegal, it constitutes, according to the PowerPoint presentation, a "serious breach of professional and ethical conduct" by denying original authors credit for their contributions. Plagiarism also can apply to materials besides publications, including conference proceedings, photographs, and charts.

Cases of plagiarism vary in severity. Accordingly, the IEEE has established five levels. The most extreme, Level 1, is the "uncredited [to the original author] verbatim copying of a full paper" or at least half of an article. The least severe, Level 5, is the "credited verbatim copying of a major portion of a paper without clear delineation," such as quotes or indents.

Punishment varies according to severity. Authors guilty of the most severe plagiarism can be prohibited from contributing work to IEEE-copyrighted publications for up to five years. Those guilty of the least severe level are required merely to write a letter of apology to the original author.

If you suspect plagiarism, or if you're an author who finds your work plagiarized, send your complaint to the IEEE IPR Office (visit the URL at the end of the article for contact information), along with copies of the original work and the work of the alleged plagiarist, much as a lawyer would submit evidence in a case. The IPR Office records the complaint and sends it to the editor in chief of the publication where the suspected plagiarism appeared.

The second tool is the flowchart. "The motivation behind putting up the flowchart is that authors, members, and editors will now know how the process of investigating plagiarism works," says Saifur Rahman, former chair of the IEEE Publication Services & Products Board (PSPB), and the person instrumental in developing the flowchart.

The IPR Office is important to the process because it can provide a journal editor with advice on the IEEE's plagiarism policies and procedures, Hagen says. The editor also forms an ad hoc committee of experts from the technical field of the material allegedly plagiarized. Experts can identify what might simply be wording commonly used to describe a technical concept—which is not plagiarism. The committee's job is to decide whether plagiarism occurred and to recommend the appropriate corrective action, if necessary.

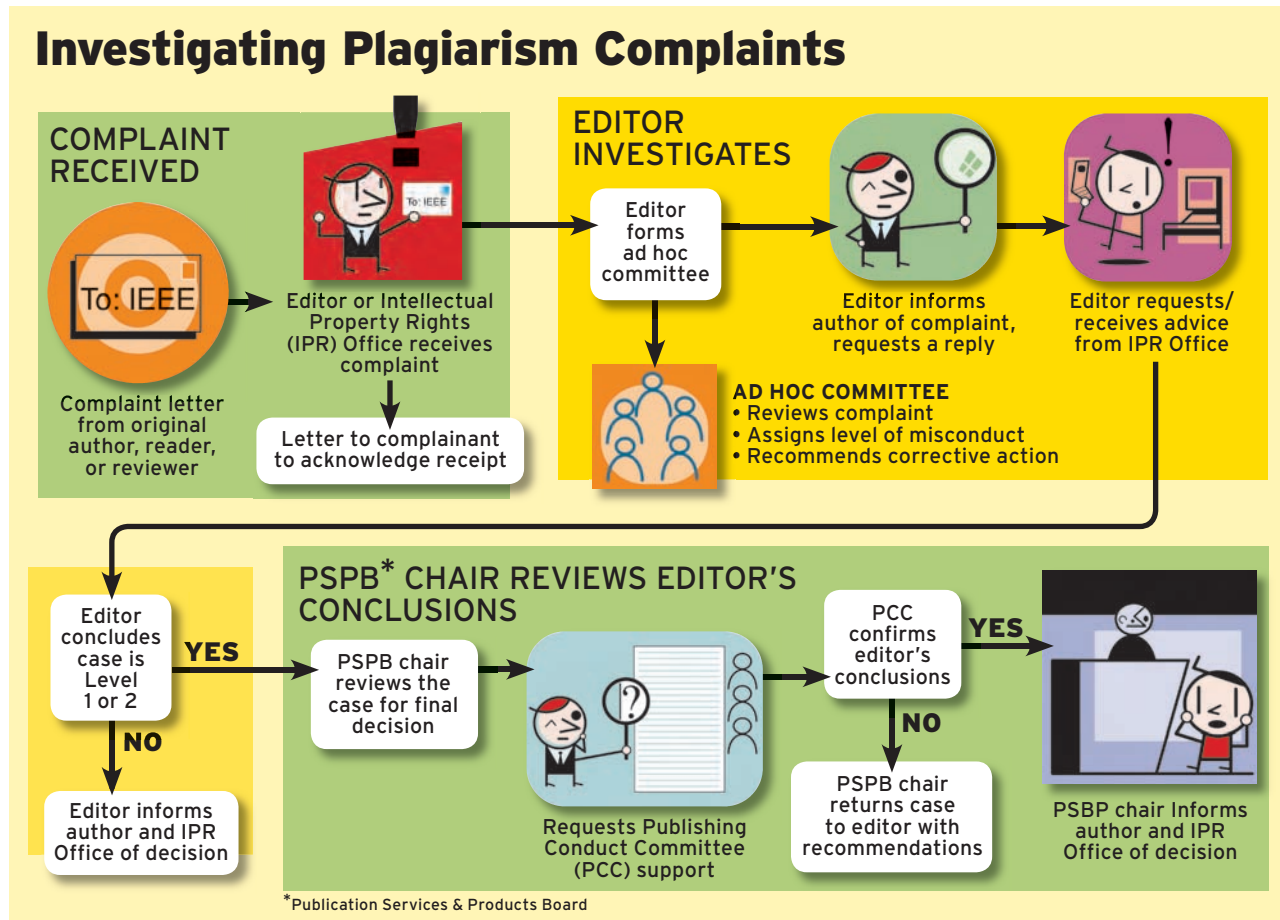
SEVERITY LEVEL From that point it's up to the editor to decide just how severe the plagiarism is. If it's serious—Level 1 or 2—the editor sends the ad hoc committee's recommendations to the PSPB chair for action. If it's less severe, the IPR Office and the plagiarizing author are notified of the decision and the corrective action to be taken.

If the process does move to the PSPB chair, the chair reviews the editor's decision and gets advice from the newly established Publishing Conduct Committee. Rahman appointed the committee in June to assist in handling misconduct cases involving publishing, including plagiarism.

If the conduct committee agrees with the editor's decision on punishment, the PSPB chair notifies the author and Hagen's IPR Office. But if the committee disagrees, the editor receives its recommendations and the cycle repeats until a course of action is agreed upon.

Besides informing members of how to avoid and report plagiarism, the IEEE is considering steps for detecting it more easily, Hagen notes. For example, the institute is considering using plagiarism-detection software that would check submitted manuscripts against those in the IEEE Xplore digital library. And it might also engage a plagiarism-detection service to check submissions against a large database of manuscripts from other science and technology publishers.

The two plagiarism tools developed by the IEEE's IPR Office can be found on the recently developed plagiarism guidelines page, at http://www.ieee.org/web/publications/rights/Plagiarism_Guidelines_Intro.html.



PUZZLED BY PEER REVIEW?

You Can Be Part of the Process

BY DEBBIE DAVY

Many years ago, I had an epiphany. I discovered that my work writing technical manuals and procedures (and sometimes business-to-business documentation) was a recognized field of study called technical communication—and that I was not alone. Not only are there many other writers like me, but also organizations such as the IEEE Professional Communication Society and the Society for Technical Communication, which publish journals with interesting articles on the latest developments in technical communication.

Eventually I decided to put my knowledge to use and volunteer for the peer review team at *IEEE Transactions on Professional Communication*. Since then, I have reviewed manuscripts for journals, conference papers, and competition entries. By sharing the ins and outs of the IEEE's peer-review process that I have learned through the years, I'd like to encourage other members to become reviewers.

HOW IT WORKS The peer-review process is designed to assess the technical merit of an article before it is published, specifically addressing the strength and logical structure of the arguments and the significance of the topic to readers. The process protects the quality and integrity of the journal.

Each reviewer evaluates articles on his or her own, and at least two reviewers look over every article. To ensure that the reviews are kept confidential and to eliminate any collusion in the recommendation of whether to publish, each reviewer does not know who the other reviewers are. Articles are also stripped of identifying information about the author or authors to ensure unbiased recommendations.

The review process typically takes three to four hours. Most reviewers:

- Read the article from start to finish, forming a general impression. Is the article exciting? Does the content flow well from one section to another? Does the article reach its intended audience?
- Reread the article. What is the main theme, and is it easily identifiable? Does the text support the theme? Are there sentences or paragraphs that do not provide useful information? Is there a plausible counterargument that the writer has neglected to address? Are there significant problems in spelling, grammar, or syntax? How effective is the conclusion?

The reviewer also receives a set of questions sent along by the journal's editor that must be answered, such as: What is the significance of the topic to journal readers? What is the connection to previously published research in the field? Who else has written about this topic, when, and in which journals? What were those authors' conclusions? What is the quality of the research approach, the research conclusions, and the presentation?

Finally it's time to recommend whether to publish the manuscript or not. Reviewers suggest three levels of acceptance: accept as is, accept with minor revision, or resubmit after major revision. In extreme cases, the article is rejected outright.

I am encouraged to do substantive editing during the process—recommending high-level revisions to the content and organization—but I do not edit for grammar, spelling, or style.

If the recommendations of the peer reviewers differ, the journal editor makes the final decision.

FIRST-TIME FOIBLES My first review was the most difficult—and not just because I was new to the process. Researching the topic, I found a paper almost identical to the one I was reviewing that was not cited in the references. I assumed that the manuscript had been plagiarized, and therefore I recommended that it be rejected. Later I learned that the author also had written the article that was not cited—and that it had been an oversight on his part not to list his own paper in the references.

Subsequent reviews have gone more smoothly. I learn a great deal from each one I do—and I have not been as quick to make assumptions.

Although peer reviewers are not paid, they receive many invaluable benefits. I get to read the newest applied research papers in many technical communication disciplines before they are published. And because I need to check the citations and technical content of the submissions, my knowledge of best practices and standards has increased—knowledge that I apply to my day-to-day work.

If you're interested in becoming a peer reviewer, contact your society's journal editor. By assisting the editorial staff of our professional journals, we make positive contributions to our field. ●

The peer-review process is designed to assess the technical merit of an article before it's published

Senior Member Debbie Davy has been a peer reviewer for IEEE Transactions on Professional Communication *since 2002. A technical communicator for some 20 years, she works for Rogers Communications, a telecommunications company in Toronto.*

This article is excerpted from one that appears on the Web site of The Quill, *the newsletter of the Society for Technical Communication, at http://www.stc-soc.org/quill/2005-04/ieeepcs.php.*

Claire Tomlin: GENIUS ENGINEER

BY ANNA BOGDANOWICZ

When it comes to helping others, Senior Member Claire Tomlin covers a lot of ground: she's a teacher at two California universities, and she's making flying safer.

Tomlin, an aviation engineer who teaches electrical engineering and computer science at Stanford and aeronautics and astronautics at the University of California, Berkeley, has developed an airplane collision avoidance system for NASA. The technology can automatically steer a plane away from a collision when radar detects another plane flying too close. And her research for the military is helping pilots on the ground control unmanned vehicles flying into dangerous areas.

For her research in aviation engineering, in September she received the MacArthur Foundation Fellowship, popularly called the "Genius Award," and a US $500000 no-strings-attached grant. The annual fellowship is given to about 25 people for their creativity, originality, and "potential to make important contributions in the future."

Tomlin was chosen for "expanding the abstract mathematical principles of control systems theory to address practical problems in such areas as aircraft flight control and collision avoidance," according to the foundation. Her research promises broad applications in military operations, business strategies, and power-grid control.

"It was a huge surprise and an honor," Tomlin says. "It's been fantastic." She says she will use the grant money in part for tuition to study genetic biology, her other love. She has five years to use the grant.

For Tomlin, the leap from engineering to biology at age 37 is all about fulfilling dreams she's had ever since she was a teenager interested in the two fields. "I always knew I wanted to do engineering, but I also wanted to study biology," she says.

A TOUGH CHOICE Tomlin has always been a math whiz. As a teenager growing up in Ottawa, she was one of 250 high school students chosen from all of Canada to participate in the Shad Valley program, which enables teens to spend the summer before their senior year studying advanced math, engineering, and computer science at one of a dozen universities.

"It's a geeky thing to do, but it's wonderful—mostly because of the people you meet," Tomlin says.

Students also get to do an internship at one of the companies that sponsor the program. Tomlin interned at Gandalf Data, a switch and modem developer in Nepean, Ont. The experience helped steer her toward engineering, she says.

Working at Gandalf, she met people who shared her love of math: electrical engineers. "I liked solving math problems—that's what brought me to electrical engineering," she says.

When it came time to choose her field of study, she was torn because she also was interested in solving medical problems. In the end, she decided on electrical engineering and attended the University of Waterloo, also in Ontario. She went on to earn a doctorate in control theory in 1998 from the University of California, Berkeley.

ENGINEERING SAFETY While still working on her doctorate in 1994, Tomlin took NASA up on an offer to conduct research on air traffic control. Her research involved programming different airplane control modes, which vary and maintain a fixed velocity and altitude automatically when the autopilot is turned on.

In 1998, she started working as an assistant professor at Stanford but continued her research for NASA, this time on aircraft collision avoidance systems. Along with one postdoctoral and two graduate students, she designed a system that uses algorithms to analyze the conditions of a possible collision and then chooses the right avoidance maneuver. When the plane's radar detects a dangerously close aircraft, the collision avoidance system automatically turns on and relies on Tomlin's software to guide the plane to safety.

The collision avoidance system has been successfully tested on a T-33 training aircraft flying alongside an F-15 fighter jet. The system is not yet being used, but Tomlin is already working on a similar one for commercial airplanes.

In 1999, she tackled another research project, this time helping automate the control of unmanned airborne vehicles by fewer pilots on the ground. Today, a number of pilots are required to operate each UAV, but Tomlin's research is changing that.

TURNING TO BIOLOGY As different research opportunities popped up, Tomlin began to wonder whether she was in the right field. "Even though I was really happy to be an electrical engineer, I kept asking myself, 'Should I have gone into biology?'" she says.

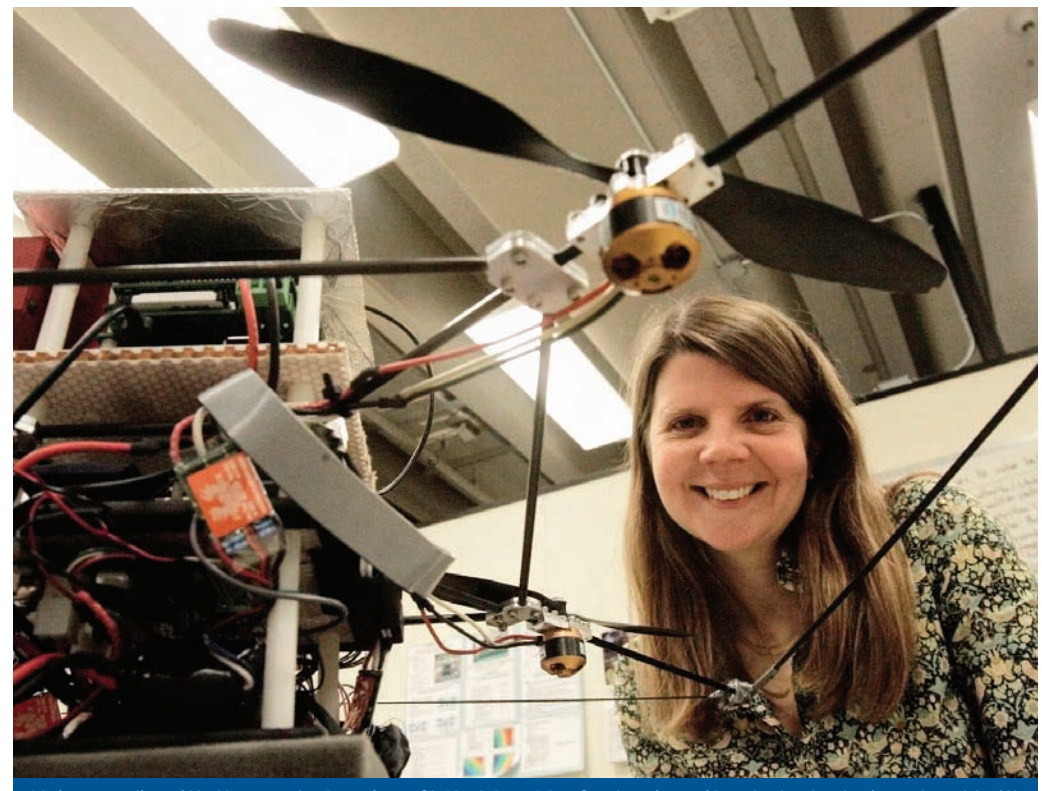
An opportunity in 2000 made up her mind: she would do both. She met Jeff Axelrod, an experimental biologist in Stanford's medical school who was working on a hypothesis about how cells in developing organisms figure out polarity—which side of the cell is which. The aim is to determine how tissues develop. That's important for biologists because many genetic disorders are caused by a defect in a cell's polarity mechanism.

Axelrod already had an idea about how cells determine polarity, but he wanted Tomlin to use her math skills to verify his hypothesis with cold, hard calculations. Now their research is helping biologists understand—and perhaps one day prevent—certain genetic disorders.

The MacArthur grant will give Tomlin the money she needs to take a break from teaching and to study experimental genetic biology. What she will learn in her biology classes will help take her research with Axelrod to new heights, she says.

"I think studying biology will be fun," she says, "but also I think it's necessary for my research." She adds that she plans to continue solving problems—both engineering and biological—as long as she can be of help.

"I'd like to accomplish something where the usefulness can be measured by how it helps people," she says.



Claire Tomlin with the quadrotor aircraft that her Stanford University students designed and built for use in unmanned vehicles. It features autonomous sensing and multiple control systems.

Real-World Projects Can Make a Difference

BY ROBIN PERESS

The IEEE's Women in Engineering (WIE) Committee and the Educational Activities Board (EAB) are teaming up to help provide universities with hands-on projects designed to encourage women to pursue degrees in electrical engineering and computer science.

The new two-year initiative, "Increasing the Representation of Women in the IEEE's Fields of Interest," is aimed at resolving problems in academia that many believe have led to a lack of female engineers. The IEEE plans to spend US $378 000 on the program.

Spearheading the initiative are IEEE Senior Member Amy Bell, an associate professor of electrical and computer engineering at Virginia Polytechnic Institute and State University, in Blacksburg, and Moshe Kam, vice president, IEEE Educational Activities.

"Women's underparticipation in electrical and computer engineering and computer science worldwide threatens the competitive vitality of the workforce and the profession," Bell wrote in describing the initiative. "It restricts the employment opportunities of half the population."

The underrepresentation of women in electrical engineering and computer science is a persistent problem that has long been recognized. In 2004, U.S. women, for example, earned fewer than 15 percent of such degrees, while they earned 46 percent of the bachelor's degrees awarded that year in biomedical engineering and 41 percent of the bachelor's degrees in environmental engineering. Other countries face a similar gender gap. For example, fewer than 10 percent of engineering degrees awarded in Japan, Italy, Spain, and South Korea went to women.

Overall, women make up 8.5 percent of all engineers in the United States, according to statistics compiled by the U.S. National Science Foundation and the American Society for Engineering Education.

DETERRENTS Several factors, including a high dropout rate after freshman year, contribute to the low number of female engineers. A large-scale U.S. study known as the Women's Experiences in College Engineering project, as well as other studies conducted at Purdue University, Virginia Tech, and elsewhere, have uncovered a number of deterrents. They include a lack of female role models, the absence of peer support, and little effort by faculty to encourage young women to stick with engineering. On the other hand, women are more likely to continue their studies after they're exposed early on to team-based, hands-on instruction that focuses on how engineering can solve societal problems.

"The conversation about why women are not doing well in undergraduate engineering programs has changed," Bell says. "It's gone from 'What's wrong with women?' to 'What's wrong with engineering education?'"

NEW APPROACH The initiative intends to change how engineering is taught by introducing practical projects in freshman classes. It calls on the IEEE to work with educators to develop hands-on projects and online workshops for freshmen.

This month, a group of engineering-school faculty will start developing proposals for projects that address real-world electrical, computer engineering, and computer science problems whose solutions can benefit society. The idea is to first present a problem in a background lecture along with at least one solution. That will be followed by a summary lecture that reviews the problem and discusses the challenges and trade-offs involved in its solution, as well as the solution's impact on society.

A review committee will approve all proposals for development. Individual lessons are to be turned into online teaching aids and posted on the IEEE Web site by November. Both the WIE Committee and the EAB are set to promote them to members and to the engineering-school community. Educators whose lessons make it to the IEEE Web site will receive $5000.

The initiative also calls for developing online workshops that showcase the best teaching practices found in electrical and computer engineering and computer science classrooms. The practices will be reviewed and selected by the same IEEE committee. The goal is to develop educational strategies that focus on the learner rather than on just the concept being taught, an approach known as learner-centered teaching. Other educational strategies include those focused on students working on team projects.

The third and last part of the initiative calls for the IEEE to promote the projects and best teaching practices at electrical and computer engineering schools. Instructors who register to use the free teaching aids and workshops will be asked to assess them.

No one expects changes in curricula overnight. "The first criterion for judging the initiative's positive impact will be simply the number of teaching aids developed," Kam says. "Another benchmark will be the number of faculty that incorporate the projects in their classroom instruction."

Several factors, including a high dropout rate after freshman year, contribute to the low number of female engineers

"My hope is that in the end we will see substantial increases in women engineers," Bell says. "But at the very least we will create high-quality materials, and anyone who uses them will benefit. It can only be a good thing."

Eventually, the program should also help establish equity and opportunity in engineering's management ranks, Kam says, adding, "When we help women, we help men as well."

DEADLINES ARE HERE

THE IEEE NOMINATIONS and Appointments (N&A) Committee seeks nominations of members to serve in both appointed and elected volunteer positions on standing committees and major boards. The N&A Committee recommends these nominees to the IEEE Board of Directors and the IEEE Assembly.

Names of candidates for 2008 must be submitted to the N&A Committee by 15 March 2007.

Openings for volunteers exist on the Audit; Awards Board; Conferences (chair only); Credentials; Employee Benefits; Ethics and Member Conduct; Fellow; History; Individual Benefits and Services; Information Technology Strategy; Nominations and Appointments; Strategic Planning; Tellers; and Women in Engineering committees.

Nominations are also sought for 2009 IEEE President-Elect and the 2008 Assembly-elected officers: Vice President, Educational Activities; Vice President, Publication Services & Products; and IEEE Secretary/Treasurer, or two individuals for IEEE Secretary and IEEE Treasurer. [For a list of elected offices, see sidebar, "Up for Election in 2007."]

General qualifications for volunteers are competence, experience, and a willingness to take on the tasks. It is also a good idea for volunteers to have the time in which to participate, along with enthusiasm, vigor, and the ability to cooperate with others in achieving the objectives of the committee or board they serve.

The deadline for nominations for 2008 is 15 March. Recommendations to the N&A Committee can be made throughout the year by fax at +1 732 981 9515, or by e-mail to nominations@ieee.org.

ON THE BALLOT On 1 May, the IEEE Board of Directors will announce the candidates to be placed on the 2007 ballot for elected positions.

The ballot will include candidates for IEEE President-Elect selected by the 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 also will have nominees for President-Elect and Members-at-Large of the Standards Association Board of Governors; Vice President-Elect, Technical Activities; and IEEE-USA President-Elect and IEEE-USA Member-at-Large. The Board of Directors is also responsible for placing proposed constitutional amendments on the ballot.

Members who are not nominated but who want to run for office may do so by submitting a petition to the Board of Directors, to be received at IEEE Headquarters no later than noon Eastern Daylight Time USA (16:00 Greenwich Mean Time), 8 June 2007. To be eligible for placement on the ballot, such candidates must submit petitions accompanied by the necessary number of valid voting members' signatures, and meet other requirements as well.

FOR MORE INFORMATION on election procedures, contact Carrie Loh, IEEE Corporate Activities, at +1 732 562 3934, e-mail: c.loh@ieee.org; or Fern Katronetsky, IEEE Corporate Activities, at +1 732 562 3932, e-mail: f.katronetsky@ieee.org.

2007 DEADLINES AT A GLANCE

15 March
- Regional nominating committees submit names of candidates for the offices of Regional Delegate-Elect/Director-Elect, as applicable.
- Divisional nominating committees submit candidates for the office of Divisional Delegate-Elect/Director-Elect, as applicable.
- Standards Association submits candidates for the offices of Standards Association Board of Governors, President-Elect, and Members-at-Large, as applicable.
- 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 due to IEEE Nominations and Appointments Committee for 2008 Standing Committee members, Assembly-elected positions, and 2009 President-Elect.

1 May
- The 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.
- The Board of Directors announces if it intends to put forward any constitutional amendment(s).

15 May
- Deadline for drafts of petitions to be submitted to the Board of Directors.

8 June
- Petitions for constitutional amendments must be received at IEEE by noon EDT USA/16:00 GMT.
- Initial statements by principal initiators and opponents of constitutional amendment(s) must be received.
- Petition nominations for candidates to be elected by the membership must be received by noon EDT USA/16:00 GMT.
- Corporate Activities must receive initial campaign statements from all annual election candidates.

19 June
- Corporate Activities mails initial statements by proponents of proposed constitutional amendment(s) to opponents, and opponents' initial statements to proponents.

5 July
- Deadline for rebuttal statements from initiators and opponents of proposed constitutional amendment(s).

1 September
- IEEE annual election ballots sent to all voting members.

1 November
- Last day, by noon Central Standard Time USA/18:00 GMT, for ballots to be received from voting members.

8 November
- Last day for ballots to be tallied by the IEEE Tellers Committee.

13 November
- Last day for announcement of vote tally to the IEEE Board of Directors by the Tellers Committee.

14 November
- Election of officers by the IEEE Assembly.

18 November
- Assembly election results announced.
- IEEE Board of Directors acts to accept report of the Tellers Committee.
- IEEE annual election results are made official.

UP FOR ELECTION IN 2007

Chosen by all voting members:
- IEEE President-Elect

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

Chosen by all voting members who are also members of the IEEE Standards Association:
- IEEE Standards Association President-Elect

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:
- Vice President-Elect, Technical Activities
- Delegate-Elect/Director-Elect, Division II (one-year term)
- Delegate-Elect/Director-Elect, Division IV (one-year term)
- Delegate-Elect/Director-Elect, Division VI (one-year term)
- Delegate-Elect/Director-Elect, Division VIII (one-year term)
- Delegate-Elect/Director-Elect, Division X (one-year term)

Chosen by members of the respective regions:
- Delegate-Elect/Director-Elect, Region 1 (two-year term)
- Delegate-Elect/Director-Elect, Region 3 (two-year term)
- Delegate-Elect/Director-Elect, Region 5 (two-year term)
- Delegate-Elect/Director-Elect, Region 7 (two-year term)
- Delegate-Elect/Director-Elect, Region 8 (one-year term)
- Delegate-Elect/Director-Elect, Region 9 (two-year term)

SOCIETY SPOTLIGHT

The Intelligent Transportation Systems Society

BY LINDSAY ELKINS

Membership in the IEEE Intelligent Transportation Systems Society (ITSS) has been growing since it became a full-fledged society two years ago. And the society is attracting an unusual array of new members, primarily civil and mechanical engineers. The reason is simple, notes the society's 2006 president, IEEE Fellow Feiyue Wang. The growth is due to the impact of electronics—especially information, communications, and intelligent systems technologies—on traditional transportation disciplines.

Starting as an interest group in 1991, the society became a council in 1999, before becoming a society in 2005. From December 2005 to December 2006, membership grew by 8.9 percent, to 1060 people.

FIELDS OF INTEREST Intelligent transportation systems are used on roads, railways, and waterways, as well as in passenger vehicles, trucks, and container ships.

PUBLICATIONS The society publishes the quarterly *Transactions on Intelligent Transportation Systems*, which covers the latest trends and research on everything from autonomous vehicles and artificial vision to global navigation systems. The publication includes profiles of the inventors and innovators behind such cutting-edge technologies.

The Web-only quarterly *ITS Society Newsletter* covers society news, conference reports, and schedules of upcoming meetings. It also publishes overviews of research programs on intelligent transportation systems.

CONFERENCES ITSS sponsors six conferences that are held periodically: the Intelligent Transportation Systems Conference; the Intelligent Vehicles Symposium; the International Conference on Service Operations and Logistics; the Intelligence and Security Informatics Conference; the American Society of Mechanical Engineers/IEEE International Conference on Mechatronic and Embedded Systems; and the International Conference on Vehicular Electronics and Safety.

The two conferences this year are the IEEE Intelligent Vehicles Symposium, which will be held from 13 to 15 June in Istanbul, Turkey, and the IEEE Intelligent Transportation Systems Conference, from 30 September to 3 October in Seattle.

AWARDS ITSS sponsors the Best Dissertation Award and three awards that are new this year: the ITS Research Award, the ITS Practice Award, and the ITS Lead Award. The Best Dissertation Award is given to Ph.D. students who have graduated in the previous three years. The recipient is selected by the ITSS awards committee and receives US $1000 plus a certificate.

Any IEEE member who has made significant contributions to the field is eligible to receive the ITS Research and the ITS Practice awards. The prizes for both awards are still being determined. The fourth award, the ITS Lead Award, will go to government organizations, research institutions, companies, and university programs that have supported the society's technologies. Its prize is yet to be determined.

JOIN THE SOCIETY at http://www.ewh.ieee.org/tc/its.

The 2007 Class of IEEE Fellows

The Institute salutes the 268 members from around the world who have been named IEEE Fellows for 2007. They join thousands of other distinguished IEEE Fellows who have contributed to the advancement of engineering, science, and technology.

Ronald Aarts
Edward Ackerman
Kamal Al-Haddad
Markus Amann
Amir Amini
Paul Antonik
Ari Arapostathis
Greg Asher
Abdullah Atalar
Jean Bacon
Roel Baets
Ross Baldick
Harut Barsamian
Luca Benini
Kerry Bernstein
Bhargab Bhattacharya
Zeungnam Bien
Henk Blom
Pradip Bose
Gregory Bottomley
Richard Braatz
Julia Brown
Richard Brown
Marc Cahay
Flavio Canavero
Claudio Canizares
Donald Chamberlin
Barry Chambers
Philip Ching Ho Chan
Abhijit Chatterjee
Ben Chen
C.L. Philip Chen
Jie Chen
Kun-Shan Chen
Kwang-Cheng Chen
Tsuhan Chen
Victor Chen
Yuhua Cheng
Akira Chiba
Andrew Chien
William Chisholm
Kwong-Kit Choi
Mo-Yuen Chow
Tat-Sing Chow
Grace Clark
Robert Colwell
Pierre Comon
Melba Crawford
Bill Curtis
Alessandro De Luca
Peter de With
Anirudh Devgan
Tadeusz Dobrowiecki
Christopher Doerr
David Dolfi
James Drewniak
Ilya Dumer
Michel Duval
Charvaka Duvvury
Gary Elko
Atef Elsherbeni
Kazumasa Enami
Vinko Erceg
John Estey
Leslie Falkingham
Masoud Farzaneh
Robert Fontana
Shangkai Gao
Wanda Gass
Gerard Genello
Fadhel Ghannouchi
Giovanni Ghione
Fulvio Gini
Maya Gokhale
Dmitry Goldgof
Avelino Gonzalez
James Goodman
Steven Gorshe
Xiaohong Guan
Ramesh K. Gupta
Zygmunt Haas
John H.L. Hansen
Boudewijn Haverkort
Gordon Hayward
Stefan Heinen
Braham Himed
Richard Hochberg
Hsiao-Wuen Hon
Davor Hrovat
Joseph Hughes
Ian Hunter
William Hurley
Seth Hutchinson
Umran Inan
Yoshio Itaya
Hideto Iwaoka
Charles Jackson
Abbas Jamalipour
Mehdi Jazayeri
William Jemison
Mu-Der Jeng
Colin Jones
Stamatios Kartalopoulos
Takayuki Kawahara
Zvi Kedem
Mustafa Khammash
Bumman Kim
Daniel Kirschen
Isik Kizilyalli
Cetin Koc
Antonius Koonen
Richard Kouzes
Ratnesh Kumar
Kenneth Kundert
Sandip Kundu
Massimo La Scala
John Lafferty
R. (Inald) Lagendijk
Jih-Sheng "Jason" Lai
Loi Lei Lai
Jean-Paul Laumond
Sang Uk Lee
Wei-Jen Lee
Steven Leeb
Wim Leemans
Naomi Ehrich Leonard
Ming Li
Shuo-Yen Li
Jerome Liang
Bao-Shuh Lin
Zongli Lin
Hui Liu
Tsu-Jae King Liu
Zhen Liu
Leo Lorenz
Alexander Loui
Zhi-Quan Luo
Jusheng Ma
Peter Magyar
Michael Mallary
Jaakko Malmivuo
Robert Menzies
Katsumi Midorikawa
Pratap Misra
Urbashi Mitra
Mitiko Miura-Mattausch
Claude Moog
Marc Moonen
Warren Mori
Biswanath Mukherjee
Alan Murray
Ayman Naguib
Walid Najjar
Robert Nevels
Clark Nguyen
Dalma Novak
Carlo Alberto Nucci
Mark O'Malley
Shinji Odanaka
Hiroyo Ogawa
Aaron Oki
Abbas Omar
Avoki Omekanda
Antonio Orlandi
Antonio Ortega
Yaakov Oshman
Gaetano Palumbo
Xiaochuan Pan
Nikolaos Papanikolopoulos
Dean Patterson
Ronald Pease
Jose Pedro
William Penn
Ioannis Pitas
David Plant
Andrew Podgorski
Carlos Portela
Jayasimha Prasad
Ruchir Puri
Li Qiu
Tawfik Rahal-Arabi
Ramachandran "Ram" Ramjee
Nalini Ratha
Thomas Richardson
Nabeel Riza
James Rooks
Christopher Rose
Keith Ross
Mario Rotea
Tom Rowbotham
Sumit Roy
Daniel Rugar
Stefan Rusu
Brian Sadler
Alan Sahakian
Sudhakar Sahasrabudhe
Hideaki Sakai
Betty Salzberg
Seiichi Sampei
Pasqualina Sarro
Ned Sauthoff
Jose Schutt-Aine
Hans-Paul Schwefel
Nava Setter
Joseph Shappir
John Sheppard
Kiyohiro Shikano
Ness Shroff
Robert Shull
David Skellern
John Smith
Nagu Srinivas
Ioannis Stavrakakis
Per Stenstrom
James Stoffel
Athanasios Stouraitis
Yan-Kuin Su
Shigeki Sugano
Toshiharu Sugie
Sehat Sutardja
Peter Sutherland
Venkataraman Swaminathan
F. Dong Tan
Gang Tao
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John Tengdin
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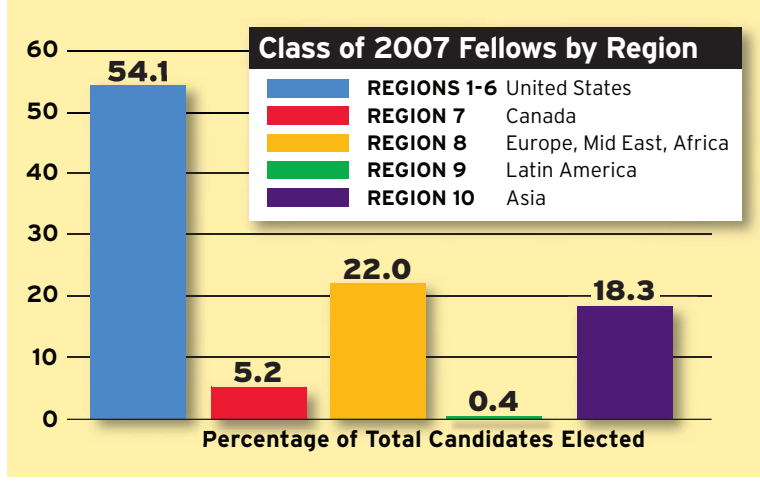
Raman Unnikrishnan
Tamaki Ura
Paris Vachon
Annamaria Varkonyi-Koczy
Rodney Vaughan
Jan Verspecht
Maximus Viergever
Bo Wahlberg
Jun Wang
Michael Wang
Roland Watkins
Marcelo Weinberger
Harold Weinstock
Kyu-Young Whang
Jeffrey Wieselthier
Kin-Lu Wong
Barry Wood
John Wood
Murray Woodside
Chwan-Hwa "John" Wu
Kun-Lung Wu
Ning Xi
Lihua Xie
Zixiang Xiong
Orly Yadid-Pecht
Hiroshi Yamada
Masakazu Yamashina
Jar-Ferr Yang
Sung-Joo Yoo
Bin Yu
Qiming Zhang
Yuang-Ting Zhang
Michele Zorzi
Moshe Zukerman



FOR MORE INFORMATION about the IEEE Fellow Program or to nominate someone, visit http://www.ieee.org/web/membership/fellows/index.html

Pedro Ray, vice president, Regional Activities [left], about to be filmed by John Day, IEEE.tv product manager [center], and two producers for an introduction to an IEEE.tv program.

IEEE, the TV Network

BY WILLIE D. JONES

For the last eight months, the IEEE has been producing videos of all types for its own TV network. So far, 16 videos about technology and engineering are available for viewing on demand from IEEE.tv.

The lineup has summaries of information presented at IEEE conferences, overviews of books put out by Wiley-IEEE Press, discussions of employment trends, and descriptions of new products introduced by the institute.

The show *Conference Highlights* includes clips from September's IEEE Custom Integrated Circuits Conference in San Jose, Calif., and discussions from the June IEEE Society on Social Implications of Technology's International Symposium in New York City. A video featuring highlights from June's Symposium on VLSI Circuits held in Honolulu was to be added in the first quarter of this year.

"We're not just taping conferences or streaming taped lectures," explains John Day, senior manager for business development for IEEE Regional Activities, in Piscataway, N.J., the unit in charge of IEEE.tv. "Our aim is to deliver finely polished productions that are not just informative but present engineering topics in a compelling manner."

Interviews with industry experts who have published books with Wiley-IEEE Press include Carl Selinger giving tips from his *Stuff You Don't Learn in Engineering School*, which focuses on the soft skills engineers need to climb the corporate ladder, or start their own business. Mark Montrose provides highlights from his book on electromagnetic compatibility, *Testing for EMC Compliance: Approaches and Techniques*, and Richard Schreier, author of *Understanding Delta Sigma Data Converters*, provides an overview of the converter technology.

Other programs include *Profiles in Volunteering*, which highlights the skill-building and leadership experience that comes with being an IEEE volunteer. *Recycling: Computers & Electronics* discusses what happens to electronic devices destined for the scrap heap at the end of their useful lives.

WHY TV? "We're trying to reach a younger demographic that is multimedia-oriented," says David Green, senior member and IEEE treasurer. He sits on the advisory board that oversaw the creation of IEEE.tv. "The IEEE has to serve four generations of members—which presents a big challenge in terms of serving them all well."

IEEE.tv seems to be reaching younger IEEE members. According to Day, although student members make up about 20 percent of overall IEEE membership, they represent close to half of IEEE.tv viewers.

"Giving them access to information on their terms will help them stay connected to the rest of the membership, to get involved in IEEE activities, and ensure that they view their association with the IEEE as an essential part of their careers," Day says.

ON THE WAY A number of IEEE groups are creating IEEE.tv programs of their own, tailored to their members' interests. Groups are lining up to ensure that videotaped portions of their conferences make their way onto the network. For example, the IEEE Broadcast Technology Society hired videographers to shoot nearly every minute of the society's annual Broadcast Symposium, held in Washington, D.C., in September. "The raw footage is being edited and repurposed in a number of ways, including long tutorials and conference highlights, and for videos aimed at encouraging membership," says Senior Member Tom Gurley, the society's past president.

Gurley likes the idea that tutorials offered at IEEE conferences and other events will not be limited to people who can travel to the meetings. "With IEEE.tv transmitting information directly to desktops, anyone can have access," he points out.

Groups are also looking to IEEE.tv's production staff to help them produce tutorials. For instance, the IEEE Professional Communication Society has expressed interest in creating videos aimed at helping engineers improve their business-writing and public-speaking skills.

Some programs will come ready-made. Day notes that the IEEE student branch at Dartmouth College, in Hanover, N.H., has asked that IEEE.tv host a video the branch produced about students there who built hybrid-electric Formula One race cars from the chassis up, as well as an upcoming competition pitting the cars against those from other schools.

Day notes that members have been offering suggestions to help make what they see as a good thing even better. There have been requests for other media players, such as Flash and Quick Time, besides Windows Media and Real players, which are the only options now available. Members also would like to download files to local drives for viewing, or to portable digital media players such as iPods so they can watch programs on the go. Another request was for closed-captioning for the hearing impaired and for those whose mother tongue is not English.

In the interest of meeting another of the IEEE's principal aims, which is to shine a positive light on the engineering profession, IEEE.tv's creators have included a general-interest series, *Careers in Technology*. It spotlights various careers in engineering, providing overviews of technological developments made possible by engineers.

Videos in the series are accessible by the general public, as a way to interest non-engineers in engineering careers, or at least give them a better understanding of what engineers do. Three episodes are available so far: "Careers in Information Technology," "Power Engineering: Careers That Make Technology Work," and "What's Out There: Careers for Electrical Engineers and Computer Scientists." Day says more such programs are in the works.

To tune in, go to the IEEE.tv welcome page at http://www.ieee.org/ieeetv. From there, you can select a program.

Programs Now Showing on ieee.tv

Conference Highlights	Meet the Authors	Careers in Technology	IEEE.tv Specials	IEEE Products
Electric Ships Technology Symposium	Richard Schreier: *Understanding Delta Sigma Data Converters*	Careers in Information Technology	The IEEE in China	IEEE Member Digital Library
Doing the Right Thing: Social Implications of Technology	Mark Montrose: *Testing for EMC Compliance: Approaches and Techniques*	Power Engineering: Careers That Make Technology Work	Profiles in Volunteering	IEEE Expert Now
Recycling: Computers & Electronics	Carl Selinger: *Stuff You Don't Learn in Engineering School*		IEEE Std. 1680 Electronic Product Environmental Assessment Tool	VuSpec Series

Federal Intelligence Award Goes to Persons

BY JASON LADAY

IEEE MEMBER Timothy Persons was honored on 15 December with the Director of National Intelligence Fellows Award for his research within the U.S. intelligence community. Persons is the technical director and chief scientist for the Disruptive Technology Office (DTO) at the Office of the Director of National Intelligence, in Washington, D.C. The annual award comes with a US $200 000 grant to be used in research addressing some of the more challenging science and technology issues facing the intelligence community today. The award was presented at the headquarters of the director of national intelligence. Persons was one of 10 recipients.

"Considering the sheer number of talented colleagues in the science and technology sector alone, this was not something I was expecting," Persons says. "It's an honor to be chosen."

Persons, 36, has been with the DTO for more than four years, overseeing research projects and planning new ones. The term "disruptive technology" describes an innovation or product that eventually overturns and replaces the existing dominant technology.

Persons has conducted research into how molecular-scale optoelectronics interact with light, quantum entanglement, and computational imaging systems.

He joined the National Security Agency in 2001 and spent a year learning cryptographic principles. He moved into the agency's Advanced Research and Development Activity as a technical director and technical program manager in its nascent quantum cryptography program. In 2005, he was named the DTO's technical director and chief scientist.

To be successful, Persons says, one must find and hold onto great mentors and be an eternal student. "To constantly learn new things challenges you and keeps you grounded in how little you really know—which is excellent for ego maintenance," he explains.

Timothy Persons [center] holds the Director of National Intelligence Fellows Award, alongside John D. Negroponte [left], the nation's first director of national intelligence, and Eric C. Haseltine, associate director for science and technology.

As for mentors, it's important to find people whose experience makes for a "treasure trove of wisdom," he says.

Persons sees himself remaining in his leadership role. "My job is tremendously satisfying," he says. He plans to invest the grant in researching ultraslow, or "stopped," light; commodity-based petascale computing systems; or an exotic computational imaging system he has in mind.

John J. Guarrera, 1974 IEEE President

BY ARTHUR P. STERN

JOHN J. GUARRERA was long active in the IEEE. He viewed engineering not just as a way of making a living but also as an important means of improving people's lives. As 1977 IEEE-USA chairman, John helped push through pension reform legislation in the U.S. Congress, and he organized the first IEEE conference on technology policy that forged connections for IEEE-USA with Washington lawmakers.

John will be best remembered for his efforts to advance the professional and social status of engineers. He felt the regard in which engineers were held should be commensurate with the vital contributions they make to society. He called for engineers to take a greater role in their professional activities, as opposed to their technical activities. He lobbied for progress in areas such as portable pensions, an engineering code of ethics, and the end of age discrimination. He expected the IEEE to play a role and aggressively lobby legislators, testify before government agencies, and participate in the bargaining needed to achieve success.

Much of this agenda was unacceptable to some of the IEEE's leaders in the 1970s and to others in the profession; they felt that engineers should focus on promoting technology. A great deal has been accomplished since then, thanks to John's leadership and the work of many others.

I got to know John in the 1960s, shortly after the merger of the Institute of Radio Engineers and the American Institute of Electrical Engineers to form the IEEE. Much had to be done to unify the two disparate organizations, with their different leadership traditions and organizational structures and the varying levels of autonomy enjoyed by their many geographically dispersed units. John and I became allies, and we two "IRE electronickers" were joined by Joseph K. Dillard, a leading AIEE "power guy" from Westinghouse. We were known as the "three rebels," who advocated integrating technical activities into the IEEE's new societies and creating a voice for U.S. members that eventually led to the formation of IEEE-USA.

John J. Guarrera

We did not always agree: John was outspokenly progressive, Joe was concerned about being "excessive," and I was in the middle. Within three years, from 1974 to 1976, each of us served as IEEE President. Being rebels was exciting; we remained friends and chuckled often when we reminisced about our "roaring '70s."

For several years John was the most senior living past IEEE president. With his passing, I have inherited that role.

A friend of Guarrera's for almost 40 years, Arthur P. Stern was 1975 IEEE President.

JOHN J. GUARRERA 82

DIED 7 December 2006

EDUCATION Bachelor's degree in electrical engineering in 1943 from MIT

FIELDS OF INTEREST Microwave components, radar systems, and command and control systems

CAREER HIGHLIGHTS New York University, 1946; City College of New York, 1947; Reeves Instrument Corp., 1949–1954; Canoga Corp., 1954–1957; private consultant, 1957–1960; Guide Manufacturing Co., 1960–1975; School of Engineering and Computer Science, California State University, Northridge, 1975–2004

VOLUNTEER ACTIVITIES Member, National Society of Professional Engineers; member, California Society of Professional Engineers; honorary life member and past president, National Computer Graphics Association; member, American Society for Engineering Education; fellow, Institute for the Advancement of Engineering; member, Tau Beta Pi; board of directors, Pension Rights Center; President, IEEE, 1974; vice president, IEEE Professional Activities (now IEEE-USA), 1977

AWARDS IEEE Fellow, 1974; IEEE-USA Professional Achievement Award, 1982; IEEE-USA Citation of Honor, 1994

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Because we know it's a confusing marketplace for auto and homeowner insurance coverage, the IEEE has done the research for you. Our selected providers offer you competitive, comprehensive, reliable coverage at special IEEE member discount rates.

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We are proud to announce that IEEE and Liberty Mutual Insurance Company have partnered to offer a program called Group Savings Plus, which provides discounts on auto and homeowners insurance to members.[1]

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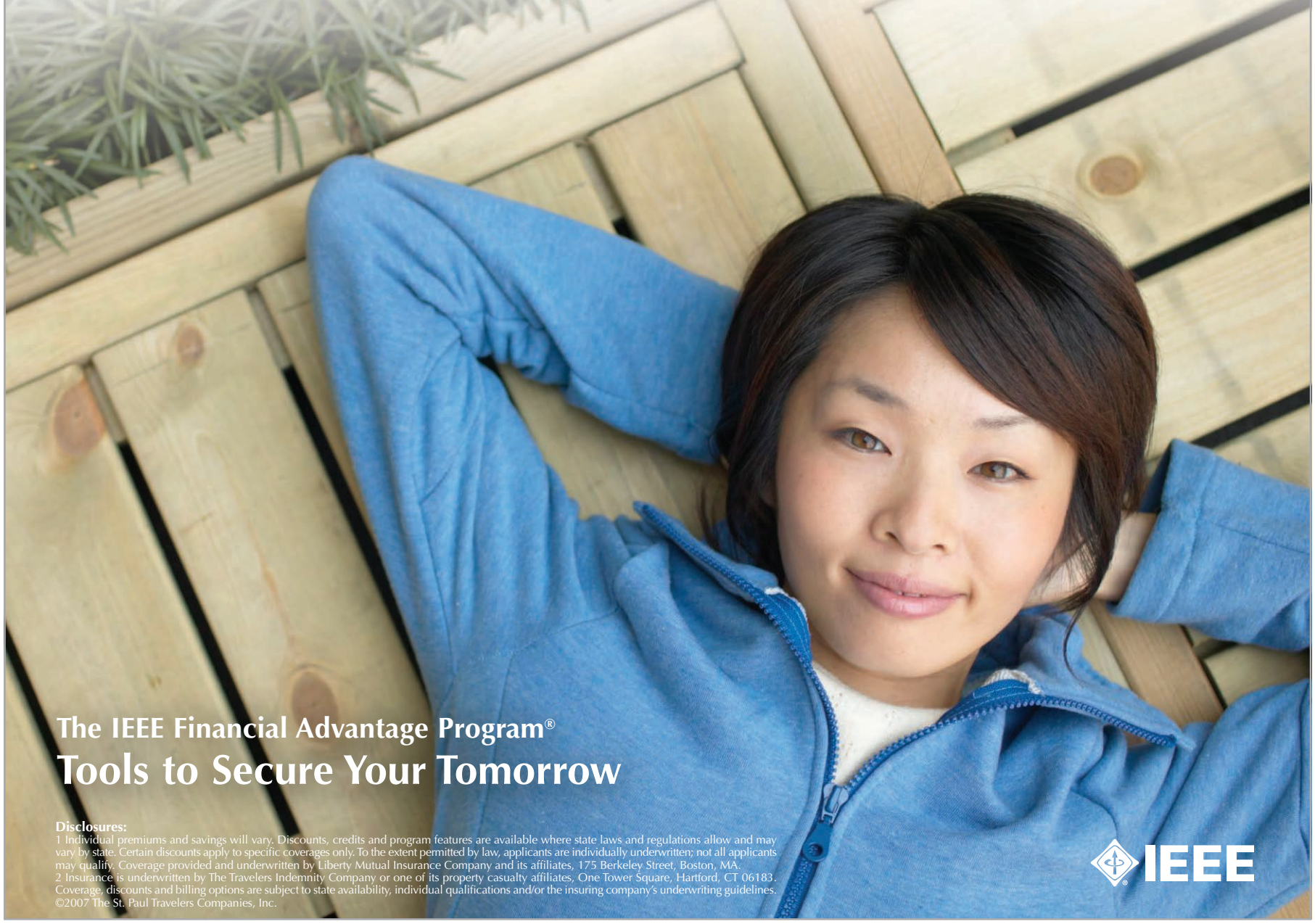

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Tools to Secure Your Tomorrow

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