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IEEE

ROVING SPACE EXPLORERS
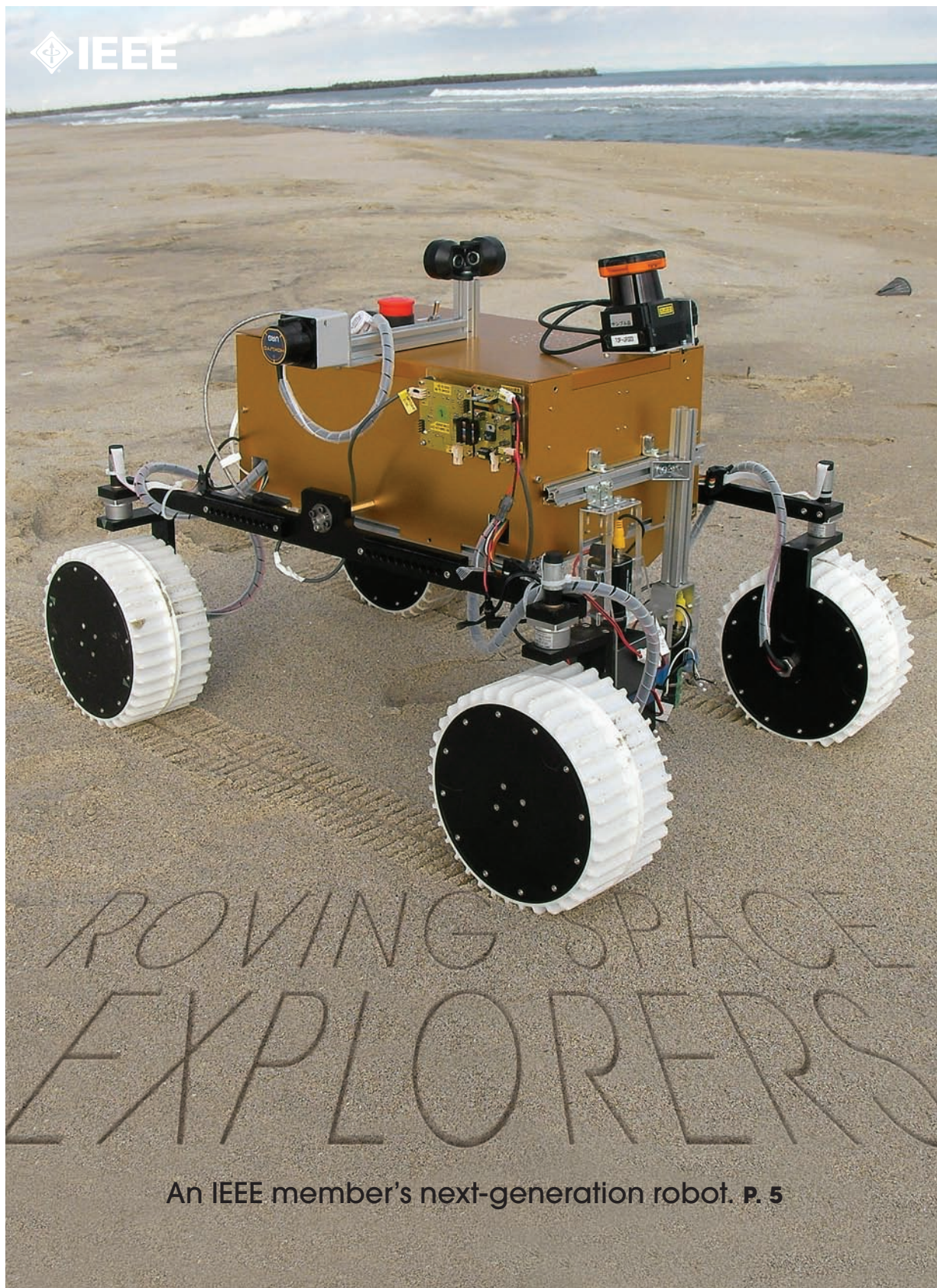
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ANNUAL ELECTION

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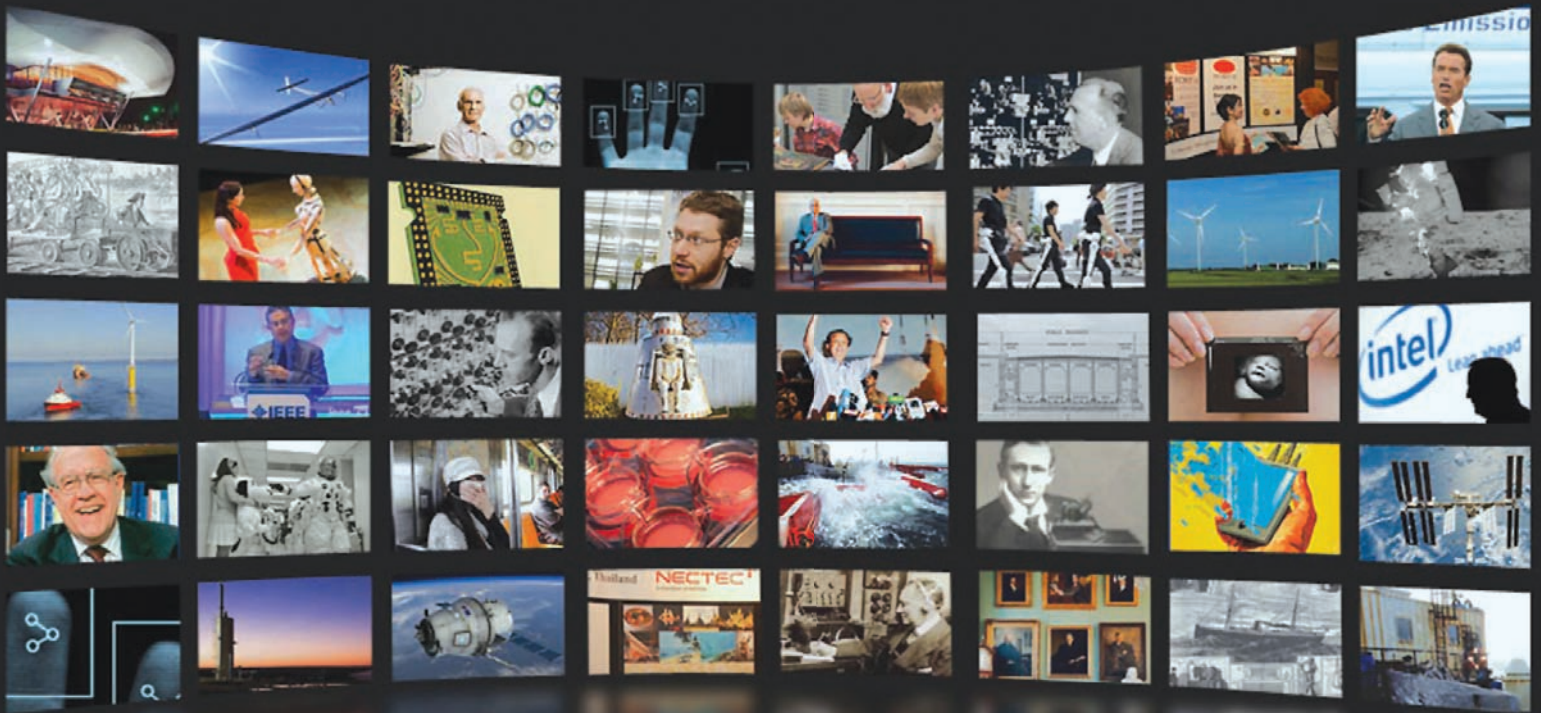
ONLINE

AVAILABLE 7 JUNE AT IEEE.ORG/THEINSTITUTE

STUDENTS' CORNER
Read about the student member benefits of a new agreement between IEEE and Microsoft.

CONTINUING EDUCATION
New IEEE Expert Now courses cover green engineering and fiber optics.

BRIEFINGS

IEEE AROUND THE WORLD

REGION 1 — Northeastern United States

■ **Worcester County (Mass.) Section** establishes chapter of IEEE Communications Society.
■ **Princeton/Central Jersey (N.J.) Section** establishes chapter of IEEE Education Society.
■ **Schenectady (N.Y.) Section** forms Women in Engineering (WIE) affinity group.

REGION 4 — Central United States

■ **Cedar Rapids (Iowa) Section** establishes chapter of IEEE Communications Society.
■ **Rock River Valley (Wyo.) Section** forms WIE affinity group.

REGION 5 — Southwestern United States

■ **Denver Section** establishes chapter of IEEE Robotics and Automation Society.

REGION 6 — Western United States

■ **Metropolitan Los Angeles Section** forms WIE affinity group.

REGION 7 — Canada

■ **Toronto Section** establishes chapter of IEEE Magnetics Society.
■ **Newfoundland-Labrador Section** establishes chapter of IEEE Oceanic Engineering Society.
■ **London (Ont.) Section** establishes Graduates of the Last Decade (GOLD) and WIE affinity groups and chapter of IEEE Power & Energy Society.
■ **Peterborough (Ont.) Section** forms Life Members affinity group.
■ Student branch formed at **University of British Columbia, Okanagan**.

REGION 8 — Europe, Middle East, and Africa

■ **Morocco Section** establishes chapter of IEEE Education Society.
■ **Czechoslovakia Section** establishes joint chapter of IEEE Industry Applications and Industrial Electronics societies.
■ **Norway Section** establishes chapter of IEEE Power Electronics Society.
■ **Israel Section** establishes chapter of IEEE Robotics and Automation Society.
■ **South Africa Section** establishes chapter of IEEE Power & Energy Society.
■ **Romania Section** establishes chapter of IEEE Broadcast Technology Society.
■ **National School of Engineers of Sfax, Tunisia**, establishes WIE affinity group and chapters of IEEE Computer, Engineering in Medicine and Biology, Robotics and Automation, and Signal Processing societies.
■ Student branch at **Dokuz Eylül University, Izmir, Turkey**, establishes chapter of IEEE Engineering in Medicine and Biology Society.
■ Student branch at the **Institute of Radiophysics and Electronics, Kharkiv, Ukraine**, establishes chapter of IEEE Electron Devices Society.
■ Student branch formed at **Al-Ahliyya Amman University College of Engineering, Amman, Jordan**.
■ Student branches formed in Saudi Arabia at **King Abdullah University of Science and Technology, Thuwal**; and **King Saud University College of Business Administration, Riyadh**.
■ **Western Saudi Arabia Section** forms WIE affinity group.
■ Student branch formed at **Al-Azhar University, Cairo**.
■ Student branch formed at the **Lebanese University Faculty of Engineering, Roumieh**.
■ Student branch formed at the **University of Pierre and Marie Curie, Paris**.

REGION 9 — Latin America

■ **Colombia Section** establishes chapter of IEEE Society on Social Implications of Technology.
■ Student branch at the **Nueva Granada Military University, Bogotá, Colombia**, establishes chapter of IEEE Antennas and Propagation Society.
■ Student Branch formed at the **Colombian School of Industrial Careers** in **Bogotá**.
■ **Pontifical Catholic University of Peru**, in **Lima**, establishes chapters of IEEE Computer and Industry Applications societies.
■ Student branch formed at the **Catholic University of St. Turibius of Mogrovejo**, in **Chiclayo, Peru**.
■ **Peru Section** establishes chapter of IEEE Robotics and Automation Society.
■ **El Salvador Section** forms GOLD affinity group.
■ Student branch at the **National Technological University, Buenos Aires**, establishes chapter of IEEE Computer Society.
■ Student branch at the **Military School of Engineering, La Paz, Bolivia**, establishes chapter of IEEE Industry Applications Society.
■ Student branch at the **University of Campinas, Brazil**, establishes chapter of IEEE Geoscience and Remote Sensing Society.

REGION 10 — Asia and Pacific

■ **Nagoya (Japan) Section** establishes chapter of IEEE Microwave Theory and Techniques Society.
■ Student branch established at **Waseda University, Tokyo**.
■ **Thailand Section** establishes chapter of IEEE Engineering in Medicine and Biology Society.
■ **Shanghai Section** establishes chapter of IEEE Electromagnetic Compatibility Society.
■ **Nanjing (China) Section** establishes chapter of IEEE Geoscience and Remote Sensing Society.
■ **Beijing Section** establishes chapters of IEEE Magnetics and Robotics and Automation societies.
■ **Chengdu Section** and **Harbin Section**, both in China, establish chapters of IEEE Computational Intelligence Society.
■ **Taipei (Taiwan) Section** establishes chapter of IEEE Sensors Council.
■ WIE student branch affinity groups formed in India at **Vimal Jyothi Engineering College, Chemperi; Basaveshwar Engineering College, Bagalkot; K.S. Rangasamy College of Technology, Tiruchengode**; and **Narayanaguru College of Engineering, Tamil Nadu**.
■ Student branch at **Swami Keshvanand Institute of Technology** in **Ramnagaria, India**, establishes chapter of IEEE Microwave Theory and Techniques Society.
■ Student branches formed in India at **R.N.S. Institute of Technology, Bangalore; Reva Institute of Technology and Management, Karnataka; College of Engineering, Poonjar; College of Engineering, Kottarakkara**; and **Dharmsinh Desai University, Nadiad**.
■ **Kharagpur (India) Section** forms WIE affinity group.

Send your region or section news to institute@ieee.org.

JUNE

3 1875: Alexander Graham Bell and his assistant, Thomas A. Watson, transmit **first speech sounds** electronically.

11 1915: Birth date of **Nicholas Metropolis**, a computer pioneer who developed the early Maniac I computer at Los Alamos National Laboratory, in New Mexico.

14 1951: **UNIVAC I**, the world's first commercial computer, begins operation.

18 1964: AT&T starts up **TPC-1**, the first transpacific submarine telephone cable, running from Hawaii to Japan.

19 1623: Birth date of **Blaise Pascal**, French mathematician and philosopher.

21 1948: The **Manchester Mark I** prototype becomes the first stored-program computer to execute a program successfully.

22–28 June: **IEEE Board Series**, Montreal.

26 **IEEE Honors Ceremony**, Montreal.

JULY

5 1888: Birth date of **Herbert Spencer Gasser**, corecipient of the 1944 Nobel Prize in Physiology or Medicine, awarded for discovering how nerve cells function.

8 1937: England begins its **999 emergency telephone system** for police, fire, and medical services.

10 1856: Birth date of electricity pioneer **Nikola Tesla**.

19 1975: The Apollo 18 and Soyuz 19 space capsules separate after docking in orbit for two days during the **first joint manned spaceflight** of the United States and the Soviet Union.

25 1857: Birth date of **Frank Julian Sprague**, developer of the first commercially successful electric streetcar system, an IEEE Milestone.

26 1989: **Robert Tappan Morris Jr.** is the first person to be indicted by the U.S. government on charges of purposely releasing a computer virus.

28 1983: NASA launches **Telstar 3A**, the first in AT&T's Telstar 3 series of domestic communications satellites.

AUGUST

4–8 August: **IEEE Region 8 Student Branch and GOLD Congress**, Leuven, Belgium.

5 **IEEE president-elect candidates debate** at Region 8 Student Branch and GOLD Congress, in Leuven, Belgium.

6 1926: **Don Juan**, the first commercial movie with a soundtrack, though no spoken dialogue, debuts in New York City.

12 1960: NASA launches the first telecommunications satellite of its own, **Echo 1**.

13–15 August: **IEEE Region 1** meeting, Binghamton, N.Y.

14 2003: A large **power outage** affects major North American cities, including Cleveland, Detroit, New York, and Toronto.

Historical events provided by the IEEE History Center. **IEEE events** indicated in red.

IEEE to Offer Limited E-Membership

AN ELECTRONIC MEMBERSHIP option for the 2011 membership year will be offered to those living in the 124 countries where the per capita gross domestic product is US $15 000 or less, as determined by the United Nations.

The basic dues for an electronic membership will be $50 and will include subscriptions to online versions of *IEEE Spectrum* and *The Institute*. The applicable regional assessment would be added to this base price. Student and graduate student dues are not affected by the program.

Those who select the electronic option will have all the advantages of standard membership, including the ability to vote in IEEE elections, join societies, engage in local activities, be considered for membership grade elevation, and access member discounts.

For members who do not live in the affected countries but need help paying their dues because they lost their jobs, retired, became disabled, or have low incomes, IEEE will continue to offer its Special Circumstances program.

IEEE president Pedro Ray explains more about the electronic membership option on p. 11.

Committees to Focus on Humanitarian Projects

THE IEEE BOARD of Directors appointed two committees at its February meeting to review IEEE's humanitarian activities.

The Humanitarian Ad Hoc Committee is to develop an overall strategy for IEEE's efforts in that area. In part, the committee is charged with identifying IEEE humanitarian projects under way and surveying activities around the world to assess where IEEE could apply its resources.

The committee is also to provide operational oversight for the IEEE Humanitarian Technology Network Initiative, which received US $290 000 in additional funding. The network is a wiki-based Web site that is to become a repository for humanitarian technology projects developed by IEEE members and others. It is expected to be a resource for communications among projects, funding sources, and humanitarian organizations.

In January, IEEE president Pedro Ray appointed the Humanitarian Technology Challenge Ad Hoc Committee. The HTC involves IEEE members, humanitarian aid workers, technologists, and others working on technical solutions for problems that plague many countries. The Challenge Ad Hoc Committee is working with the HTC Steering Committee to recommend future directions to the Board, including a plan to assess the HTC's benefits. The IEEE Board authorized $320 000 for the challenge program in 2010.

IEEE Election Kicks Off in August

LOOK FOR YOUR annual election ballot package to arrive in August via first-class mail. Those eligible to vote include new members as of 30 June and those elevated to member or graduate student member grade on or before that date.

update your IEEE membership information by 15 June

Members who have moved should update their contact information by 15 June to ensure they receive the package. Graduating students should update their educational data so they can be elevated to graduate student member or member grade. Student members and graduate student members graduating between 1 January and 30 June are automatically elevated to professional member grade in June each year. Make sure to update your information so you don't miss opportunities to get involved.

To change your contact information and other personal data, visit http://www.ieee.org/go/my_account.

Associate members may not vote in the annual election. They may, however, apply for elevation to member grade by 15 June by submitting their résumés and IEEE associate member numbers to resume@ieee.org.
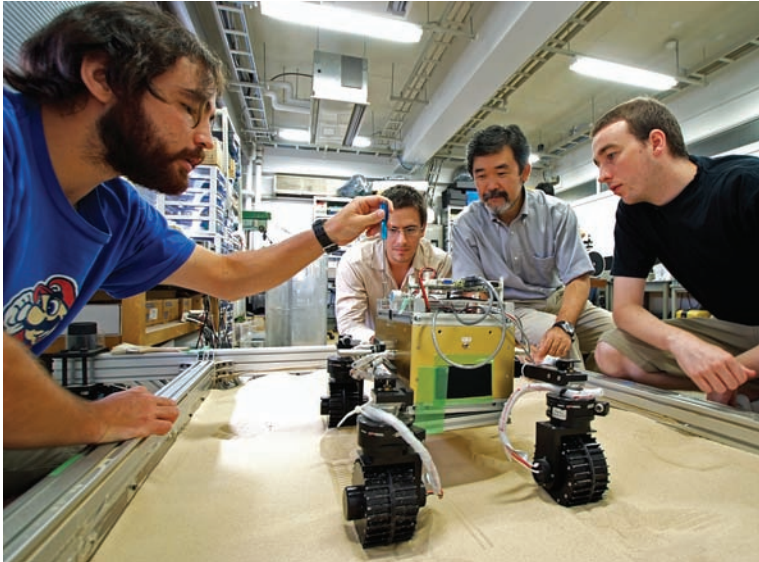
ELECTION DEADLINES
1 AUGUST IEEE annual election ballots are sent to all voting members by this date.
1 OCTOBER Last day for members' marked ballots to be received by IEEE, by noon central daylight time, USA (17:00 UTC).
8 OCTOBER Last day for ballots to be tallied by the IEEE Tellers Committee.
21 NOVEMBER The IEEE Board of Directors acts to accept the Tellers Committee report. Annual election results are made official.

Kazuya Yoshida (second from right) works on a prototype of El Dorado II with his team in the Space Robotics Lab at Tohoku University, in Sendai, Japan.

Roving Space Explorers

Next-generation robots are stepping in for humans BY ANNA BOGDANOWICZ

IT HAS BEEN about four decades since a human set foot on the moon. With space agencies facing major financial challenges, missions to send people back to the moon and elsewhere in space are on the back burner. But that isn't stopping IEEE members from trying to expand our knowledge of the universe with nonhuman explorers: robots.

Space robots come in many shapes and sizes. Planetary rovers explore the surface of moons and planets, taking photos and soil samples and sending the data back to labs on Earth. Orbital robots, a relatively new type, service orbiting satellites or assemble parts of a space structure. The Japan Aerospace Exploration Agency (JAXA), the U.S. Defense Advanced Research Projects Agency, and other organizations are experimenting with orbiting prototypes. And probes are landing on asteroids. JAXA's Hayabusa probe, for example, alighted on the surface of the asteroid Itokawa in 2005 to collect soil samples . Hayabusa is expected to return to Earth this month.

The first robot to explore an extraterrestrial body was Lunokhod, launched in 1970 by the Soviet Union to explore the moon. Remotely operated from Earth, Lunokhod traversed 10.5 kilometers of the moon surface, taking photos and analyzing the soil.

During the past decade, there were major breakthroughs in space robotics, notably by NASA's autonomous Mars rovers, Spirit and Opportunity, which landed on the Red Planet in 2004 and continue to send back photos and data.

The two rovers have encountered numerous obstacles. Opportunity got stuck in the soil for several weeks in 2005 before engineers could get it moving again. And Spirit is now immobile, trapped in sand, struggling to tilt its solar panels toward the sun for some extra electric heat before the extremely cold Martian winter hits.

The rovers' troubles have helped researchers such as IEEE Member Kazuya Yoshida understand how to build a better crop of robotic explorers. Yoshida, a professor of aerospace engineering at Tohoku University, in Sendai, Japan, is an expert on the mechanisms and control of space robots, including planetary rovers and asteroid robots such as Hayabusa, which he helped design. He was featured in the December 2009 issue of *IEEE Robotics & Automation Magazine,* which was dedicated to terrain mapping, sensors, robotic-wheel traction control, and other space robotics technologies.

"For lunar and planetary exploration, robots are especially critical, because human access to the hostile space environment is very difficult or in many cases not yet possible," Yoshida says.

INTO THE UNKNOWN

Yoshida and his team of researchers at the university's Space Robotics Lab have been working on several advances in planetary rovers. One involves improving the topographic mapping techniques robots use as they prepare to traverse the landscape. Robots map their environment using sensors and then plan a safe route. The researchers are also working on modifying the traction mechanics of the robot wheels to prevent rovers from getting stuck in soil.

The lab's most recent creation, a robot named El Dorado II, showcased its advances at the planetary rover contest during last year's IEEE Robotics and Automation Conference, in Kobe, Japan. Five robots tried to move about a Mars-like terrain. The fully autonomous El Dorado II, which snagged first place, was the only one to successfully map the test course, navigate across the bumpy gravel field littered with rocks, reach a target, and return to its base. The robots' human minders had no prior knowledge of the course, so their robots had to deal with whatever they encountered, including rocks and sand.

To make sure El Dorado II can overcome obstacles, Yoshida has been working with new sensing and navigation techniques. To map its environment before it sets out, El Dorado II uses a cutting-edge technique called 3-D simultaneous localization and mapping. The robot uses laser sensors to capture layers of its surroundings by measuring the dimensions of the topography within a range of about 30 meters. It builds a three-dimensional map by superimposing the multiple layers to form a complete view of the area.

El Dorado II uses an iterative closest-point algorithm to construct the map. Originally, the algorithm was developed as a way of registering 3-D shapes for computer graphics, but it is now widely used in mobile robotics to construct topographic maps. Once the map is completed, El Dorado II determines the best path for avoiding obstacles.

SAND TRAPS

As the Mars rovers demonstrated, it's pretty easy to get stuck but difficult to get free. Yoshida is working on ways to ensure a robot doesn't get trapped in the first place. That means focusing on the wheels.

NASA's Mars rovers are successful at moving over bumpy, rocky terrain, he notes, but they have a more difficult time going over sand, because the wheels can slip, causing them to grind into the ground and get stuck.

Yoshida and his team developed a system that addresses the wheels' slip ratio, which is the difference between a wheel's tangential speed and the speed of the axle relative to the ground. When the wheels have different slip ratios and one wheel is going faster than the others, the robot can get stuck. "The idea," Yoshida says, "is to control the rotational velocity of each wheel so their slip ratios are equal."

To do that, El Dorado II uses an onboard video camera to observe the terrain texture beneath it. By differentiating the successive terrain images, optical flow vectors are obtained. Sensors in the robot's inertial measurement unit analyze the vectors to estimate the slip ratio and slip angle of each wheel. Based on that, the robot's control system adjusts the speed and angle of the wheels to minimize slippage.

Yoshida says he hopes his space-robotics work helps society explore parts of the universe impossible for humans to visit. "Robotic exploration is absolutely necessary to expand the horizons of our knowledge and presence in space," he says. "Robots should be a precursor to any future human expeditions." ∎

GORDON W. DAY

JOSEPH V. LILLIE

Getting to Know Day and Lillie

BY ANNA BOGDANOWICZ

KNOWING WHERE the candidates for 2011 president-elect stand on IEEE issues is vital to deciding who you'll vote for when you receive your ballot in August for the annual IEEE election. But there's much more to the two candidates—Gordon W. Day and Joseph V. Lillie—than their positions on serious topics. Before we cover those in our September issue, here's a look at their personal sides. You might be surprised to learn what they have in common and what you, too, might share with them.

Day, a Life Fellow and the 2009 IEEE-USA president, was a researcher and manager at the U.S. National Institute of Standards and Technology, in Boulder, Colo., for 33 years before retiring in 2003. His research focused on optoelectronics, including fundamental physical measurements, standards for optical fiber, and the development of new types of instrumentation. In 1994 he founded and became the first chief of the NIST Optoelectronics Division. After leaving NIST, he served as science adviser to Senator Jay Rockefeller (D-W.Va.) on an IEEE-USA congressional fellowship and later as director of government relations for the Optoelectronics Industry Development Association. He also worked as a consultant, specializing in optoelectronics technology and science policy. Day, the 2000 president of the IEEE Photonics Society, has held numerous other IEEE positions.

Lillie, a senior member, has 37 years of experience in telecommunications engineering and management. He held a number of positions at BellSouth Telecommunications facilities in Louisiana from 1973 to 2002, including design engineer, planner, planning manager, district support manager, and engineering manager. When he retired from the company in 2002, he was a member of the Louisiana BellSouth state staff, providing engineering and construction support. In 2003 he joined NorthStar Communications Group in Birmingham, Ala., as director of corporate quality, and in 2005 he returned to BellSouth (now AT&T) to work on restoration projects following Hurricane Katrina. He continues to provide part-time engineering support to AT&T in Louisiana. He has held various IEEE positions, including vice president of Member and Geographic Activities in 2008 and 2009 and director of the IEEE Foundation. Lillie was the runner-up in the election for 2010 IEEE president-elect.

IF YOU WEREN'T AN ENGINEER, WHAT WOULD YOU BE?

DAY: I always wanted to be a philanthropist but lacked a key qualification. Realistically, I think I was destined to be some kind of technologist. My parents told me that I began building things and taking things apart when I was very young. I chose electrical engineering for its breadth, but I think I could have been happy as a civil or mechanical engineer.

LILLIE: Early in my college days I considered changing my major to accounting but never did. As a kid I always wanted to know how things worked. I would tear them apart to see what was inside, so becoming an engineer was a given.

WHAT GADGET OR TECHNOLOGY CAN'T YOU LIVE WITHOUT?

LILLIE: My favorite gadget is my iPhone. I used a BlackBerry for many years and only recently changed to the iPhone. It still amazes me the way technology has progressed over the years.

DAY: That's an easy one. Most of the things that contribute to our quality of life are powered, or otherwise enabled, by electricity. It should remind us that one of the most effective things we can do to improve the quality of life in less developed parts of the world is to provide greater access to electricity. It doesn't have to be large projects but could be small-scale solar, wind, or hydro.

HOW DO YOU FEEL ENGINEERS' WORK BENEFITS HUMANITY?

DAY: It's hard to think of anything that has improved our quality of life in the past century or so that wasn't developed by applied technologists. I like the famous quote from Theodore von Kármán, an early 20th-century rocket scientist: "… engineers create a world that has never before existed." More than most professions, applied technologists create jobs and increase prosperity.

LILLIE: IEEE's mission is to foster technological innovation and excellence for the benefit of humanity. As IEEE members, we work together to accomplish this mission, creating new technologies and then sharing them with the world.

HOW WAS YOUR COLLEGE EXPERIENCE AND WHAT WERE YOU LIKE AS A STUDENT?

LILLIE: College was a lot of fun. I lived in a dorm while attending the University of Southwestern Louisiana [now the University of Louisiana at Lafayette]—which allowed me to become good friends with the students living there, participate together in activities, and study with them. I was involved in numerous campus activities even though I always held a part-time job. I also attended all the school's sports events.

DAY: Any of my classmates who read this would probably say that I was a classic nerd. I did enjoy some of my non-technical elective classes, though, including one in art history that led to a lifelong interest in art and artistic crafts.

WHAT IS YOUR FAVORITE COLLEGE MEMORY?

DAY: Visiting the engineering library to talk to the librarian (I married her).

LILLIE: Serving as the college of engineering's representative on the student government association. The experience taught me a lot about listening to the views of others and the need to work toward shared accomplishments.

FAVORITE VACATION SPOT?

LILLIE: Home in Lafayette, La. I enjoy the time I spend with family and friends.

DAY: Many of our vacations have been to visit family. Right now we're looking forward to visiting our two oldest grandsons and their parents. As for travel destinations, I'm always happy to return to Japan, the United Kingdom, Scandinavia, and Australia.

FAVORITE THING TO DO IN YOUR FREE TIME?

DAY: Since I was young, I've liked working with wood. I've done some large projects, but over the past few years I've mostly focused on using a lathe to turn small objects, such as bowls, plates, and pens.

LILLIE: Playing with my five grandchildren. My wife and I have a lot of fun with them. They are very creative and may even be future IEEE members.

WHAT WAS YOUR MOST MEMORABLE IEEE EVENT?

LILLIE: I have always enjoyed the IEEE Honors ceremonies. We honor the best of the best and get to meet those who have contributed so much to the development of products that benefit humanity.

DAY: The opportunity to work as a science adviser to a U.S. senator as an IEEE-USA Congressional Fellow provided lots of memorable experiences: learning how the legislative process works (or doesn't); meeting the decision makers, including then-Senator Barack Obama; sitting on the Senate floor watching debates; crafting language that appeared in legislation or the *Congressional Record*; and many others.

WHAT LESSON HAVE YOU LEARNED THAT YOU WOULD LIKE TO PASS ON TO OTHERS?

DAY: I tell young engineers and scientists that their professional success is not their employer's responsibility but their own. It's a much more important concept now than when I was young. Today's technologists will hold many jobs. The extent to which they maintain and expand their skills will determine how well they succeed.

LILLIE: Develop your nontechnical skills. Technical skills are important, but nontechnical skills can help you better utilize your technical capabilities.

WHAT IS YOUR FAVORITE TYPE OF MUSIC?

LILLIE: Country and Western.

DAY: My wife and I often attend classical concerts—orchestral, chamber, and choral—and our CD collection is mostly classical. While working at my computer, I frequently stream jazz or folk tunes from the 1960s and '70s.

WHAT HAS BEEN THE MOST CHALLENGING MOMENT OR PROJECT OF YOUR CAREER?

LILLIE: Shortly after Hurricane Katrina struck the New Orleans area [above], I was asked to return to BellSouth to assist in the restoration efforts. It was a very challenging time, especially knowing that so many families were depending on us to get their lives back together. Working as a team, we were able to make a difference.

DAY: Perhaps it was the very first step, making the transition from a high school class of 50 (I don't think any of us had ever met a practicing engineer) to a highly competitive university environment where there were over 30 000 students.

WHO IS YOUR ROLE MODEL, AND WHY?

DAY: As I get older, I increasingly recognize the impact my father had on my life—the skills and attitudes he passed along. I often catch myself behaving as I think he would have. In a broader perspective, I've always admired Thomas Jefferson's vision and eloquence, his interest in applying technology to everyday tasks, and his global view. I recommend visiting Monticello, his home in Virginia.

LILLIE: My father. He taught me that the key to success was to respect others.

DO YOU HAVE ANY FEARS?

LILLIE: My greatest fear is having to eat a meal without Tabasco sauce.

DAY: The mountain lions (cougars) that have been turning up in my Boulder, Colo., neighborhood make me a little nervous. See: *The Beast in the Garden*, a book by David Baron.

WHAT IS THE BEST ADVICE YOU'VE EVER RECEIVED?

DAY: "Make yourself indispensable," said to me by my first boss, when I asked him about turning my then-temporary job into a permanent one.

LILLIE: My parents always stressed the need for education, and over the years I have passed this on to others.

FAVORITE TV SHOW?

LILLIE: "The Big Bang Theory."

DAY: I watch quite a bit of television news, mostly time-shifted. When channel-surfing, I tend to land on documentaries or sports events.
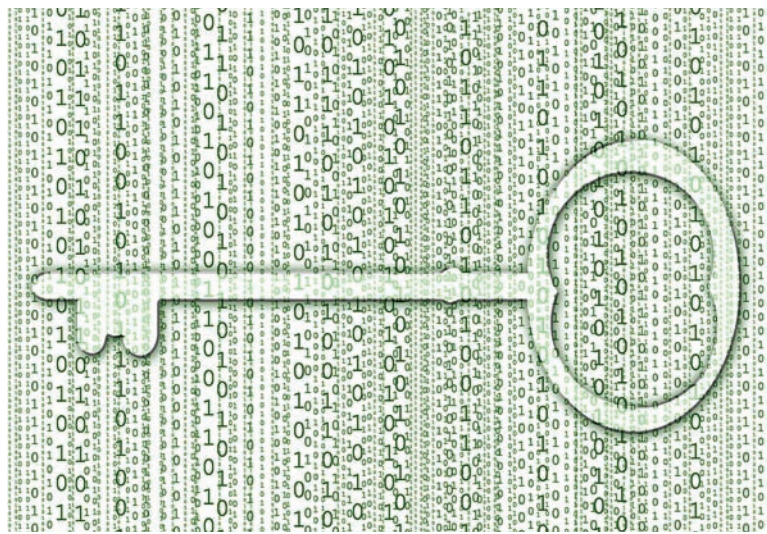
Cryptography Breakthrough Is 100th Milestone

BY ANNA BOGDANOWICZ

EVERY TIME you buy something online, you can thank public-key cryptography for the security of the purchase. The 1970s breakthrough made possible safe communications and e-commerce, and it laid the groundwork for the digital revolution.

Public-key cryptography uses asymmetric algorithms in communications devices such as computers and mobile radios to encrypt and decrypt messages. The algorithm on the sender's end uses a code, or key, to encrypt a message, and the recipient uses a different key to decrypt it—hence the description "asymmetric."

But who is to thank for inventing the technology? The answer is not so straightforward. Many have credited a group of researchers at Stanford and MIT who made the discovery in 1975. Those Stanford researchers, Whitfield Diffie, Martin Hellman, and Ralph Merkle, are this year's recipients of the IEEE Richard W. Hamming Medal for their work on public-key cryptography.

But in the early 1970s, British researchers James Ellis, Clifford Cocks, and Malcolm Williamson secretly invented public-key cryptography while working at a British intelligence agency, the Government Communications Headquarters (GCHQ), in Cheltenham, England.

For decades their work went unknown. It was declassified in 1997. Ellis died shortly before he could enjoy the public recognition.

To make sure the inventors receive their due, a group of IEEE members from Region 8 nominated the invention by Ellis, Cocks, and Williamson for an IEEE Milestone in Electrical Engineering and Computing, IEEE's 100th.

SECRETS AND SPIES

Cryptography was once mostly used by companies to protect business confidentiality, by intelligence agencies coding their own messages and trying to decode intercepted phone and radio messages from other countries, and by military commanders during war to communicate orders to their troops.

Prior to public-key cryptography, the security of all encrypted messages depended on the exchange of a secret key, contained in a codebook, for example, that was in the possession of both the sender and the recipient. The challenge was getting the sender and receiver to agree on a secret key from among many possibilities in the book—without anyone else discovering it. If they were in separate locations, they entrusted a courier, a phone system, or some other transmission medium to share the secret key. Anyone who intercepted the key in transit could use it to decrypt the messages.

The vulnerability of those methods, as well as the high cost and inconvenience of sending the keys securely, led intelligence agencies in the late 1960s to seek alternatives. Most researchers studying cryptography at the time, however, said it wasn't possible to devise a better system. Enter Ellis, a physicist at GCHQ, who in 1969 set out to do just that.

PROVEN POSSIBLE

By the end of the year, Ellis had demonstrated to the agency's senior officials that public-key cryptography was attainable, but because he wasn't a mathematician, he did not know how to implement his concept.

In 1973, Cocks, a mathematician, was asked to join the effort. It is said that he found a solution in just 30 minutes, but it couldn't be used because the computers of the day weren't advanced enough. A year later, Williamson, also a mathematician, began investigating Cocks's solution and eventually found a method that did work, leading to public-key cryptography.

Each person uses a pair of keys; one is a public key to send messages, and the other is private, known only to the recipient. The need for the sender and receiver to share secret information is eliminated; all communications involve public keys, and no private key is ever transmitted or shared. Only the recipient's private key can decrypt the message. The keys are related mathematically, but the private key cannot feasibly be derived from the public key given current computational limits.

IEEE plans to mount a plaque recognizing the Milestone at GCHQ's main operational building at Cheltenham. The plaque will read:

"At GCHQ, by 1975 James Ellis had proved that a symmetric secret-key system is unnecessary and Clifford Cocks with Malcolm Williamson showed how such 'public-key cryptography' could be achieved. Until then it was believed that secure communication was impossible without exchange of a secret key, with key distribution a major impediment. With these discoveries the essential principles were known but were kept secret until 1997." ■

Back at the Beginning

Now that IEEE has 100 Milestones, with more on the way, *The Institute* decided to look back at the very first ones.

In 1977, prior to the formation of the IEEE Milestones in Electrical Engineering and Computing, IEEE was a cosponsor of the American Society of Civil Engineers' milestones program, known as Landmarks. The organizations jointly honored the Mill Creek No. 1 Power Plant, a hydroelectric facility in Redlands, Calif., that began operating in 1893. It was the first in the United States to use commercial three-phase alternating current generators.

Later in 1977, IEEE codesignated another joint Landmark: the Vulcan Street Power Plant, in Appleton, Wis., which was the world's earliest hydroelectric central station when it began operation in 1882.

As IEEE prepared to celebrate its centennial in 1983, it created its own Milestones program. A year later, IEEE approved three Milestones. The first to be dedicated was the Westinghouse Atom Smasher, in May 1985. It was the world's first industrial atom smasher, built in 1937 at Forest Hills, Pa.

In June 1985 came the dedication of the Cable Landing at Heart's Content, Nfld., Canada, recognizing the inaugural placement of a transatlantic cable in 1866. The third Milestone honored reception of a radio signal at Signal Hill, also in Newfoundland, which was dedicated in October 1985 to recognize the first transatlantic radio signals, received by Guglielmo Marconi on 12 December 1901.

MARKETPLACE OF IDEAS

THIS MONTH'S QUESTION:

Diversity and Competitiveness

For an article it planned to publish, the *San Jose Mercury News,* in California, set out to obtain data on the race and gender of the employees at 15 Silicon Valley companies through a U.S. Freedom of Information Act request. Nine of the firms agreed to share the information, saying they had nothing to hide. The other six refused. Apple, Applied Materials, Google, Oracle, and Yahoo convinced federal regulators who collect and release the data that disclosure in the newspaper could cause the companies economic harm by revealing their business strategies to competitors. The sixth company, Hewlett-Packard, fought the release and lost.

Should the companies be forced to release their demographics? How important is diversity to the competitiveness of a company?

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 September issue of The Institute *and may be edited for brevity. Suggestions for questions are welcome.*
MAIL: The Institute, *IEEE Operations Center, 445 Hoes Lane, Piscataway, NJ 08854-4141 USA* **FAX:** *+1 732 562 1746* **E-MAIL:** *institute@ieee.org*

RESPONSES TO MARCH'S QUESTION

When Particles Collide

The Large Hadron Collider was turned back on in November after breaking down 14 months earlier, and it quickly recorded its first proton-proton collision. The LHC was developed to search for new particles and properties of nature by colliding two counter-rotating proton beams. Supporters say the collider could help scientists answer some of the most fundamental physics questions and might even explain how the world began. But critics say building the US $10 billion machine is a waste of time and money. It might even be dangerous, they add, because it could create tiny black holes, although physicists have refuted that idea. Other critics say the laws of nature will prevent the collider from making any breakthroughs.

Is the LHC a worthwhile scientific endeavor? Will it help answer important questions about the nature of our universe?

A Reasonable Idea
Because the cost of the LHC is shared among many countries and the majority of physicists feel it will yield useful information, I think the LHC is reasonably valuable for the money. I don't believe there's any danger of black holes; many physicists have already considered and rejected that. It's also a fact that very high energy cosmic rays have not created black holes, or if they have, the black holes have vanished before we could find them. Life is full of risks, which we should undertake as long as they are reasonable.
PAUL GREGG
Seymour, Wis.

Unexpected Results
It's often true that the most successful experiments deliver unexpected—even unintended—results. In the case of the LHC, the worry seems to be that black holes could be formed and destroy all or parts of Earth. On the other hand, doing nothing will bring us no new knowledge. I'm for getting the LHC up to its design specs and seeing what results can be obtained—expected, unexpected, intended, unintended, whatever. Let the results speak to whether it was worth the cost.
WILLIAM L. SCHULTZ
Ridgecrest, Calif.

It's a Waste
The LHC is a massive waste of money that could be much better spent on improving the lives of people around the world. This is science creating its own idol for knowledge's sake.
BRONWEN PARSONS
Toronto

Answers to Basics
The LHC will help us understand the most fundamental physical laws of our world. We do not yet understand at the most basic level how gravity is related to nuclear and electromagnetic forces, whether our understanding of how matter acquires mass is correct, or whether there are supersymmetric counterparts to familiar particles such as the electron. The LHC experiments are the logical next steps in answering those questions.

Of secondary importance are the tangible benefits we gain from curiosity-driven research. Complicated physics projects such as the LHC drive developments in electronics, computer science, and other areas. Many of the hundreds of students who receive their technical training working on these projects will go on to develop products with widespread benefits based on what they have learned. Let's not forget that the Internet was initially conceived as a tool to share papers about particle physics among researchers.
MICHAEL BURKA
Winchester, Mass.

Could Be Worse
I'd rather see humanity go down in a black hole during its quest for science than to see it destroy itself with nuclear weapons, which have already cost far more than $10 billion.
SHERIF ZAIDAN
Garching bei München, Germany

Hard to Believe
I have heard several superstitious theories as to why the collider will fail. One claims that people from the future who think it might destroy the world are preventing the LHC from working. That's why they sent a time-traveling bird to stop it. [Last year a bird dropped bread on a section of LHC's outdoor machinery, eventually leading to significant overheating in parts of the accelerator.]

Despite such theories, the LHC succeeded with its first collision, which I think is enough to refute the theory of a time-traveling bird. I hope that after results are analyzed, scientists can tell us whether their theories of the so-called God particle are true, which can clarify the mysterious nature of gravity.
POOYAN SAKIAN DEZFULI
Eindhoven, Netherlands

Nonsense
Building bigger and better particle colliders just doesn't make economic sense. We can do a lot with $10 billion that would be far more productive than sending protons around a glorified roller coaster. The dangers of creating mini black holes are probably minimal, but the benefits of achieving significant breakthroughs are also minimal. One day we'll discover we need a supercollider larger than Earth to achieve meaningful results. Until then, any significant breakthroughs are better left to particle theory.
MICHAEL B. MEINER
Highland Park, N.J.

I agree with the 38 percent of engineers polled who say, according to the article, the gender gap is not an issue. On the opposite end of the gap spectrum we see no initiatives to make men more interested in careers like nursing or laboratory science. In fact, there is not a single initiative to get men more interested in fields dominated by more than 95 percent of women, such as teaching elementary school. Persuading people to choose a career they otherwise would avoid just leads to more people wasting valuable time pursuing something that will not fulfill them.

MARK KELCOURSE
Greensboro, N.C.

Innovators' Rights

In "Marketplace of Ideas" [March, p. 9], I found it discouraging to see so many readers condemn exclusive contracts, such as the one between AT&T and Apple, as harmful to innovation without considering the principle at stake: individual rights. Don't the owners of those companies have the right to freely contract with others, or are they second-class citizens who exist solely to serve the desires of consumers?

Steve Jobs and other innovators create their products in order to bring their ideas to reality according to their own vision. Consumers who would prefer something different are free to look elsewhere. Advocating the right to dictate with whom and on what terms innovators may contract jettisons the principle of rights and undermines a necessary precondition of innovation: freedom.

JIM ALLARD
Madison, Wis.

Gender Gap Views

The article "Looking at the Gender Gap" [March, p. 7] seems more likely to hurt feelings and irritate readers than to change people's way of thinking. For example, a number of my colleagues and I felt this quote from Karen Panetta was simply off-putting and hurtful: "What are electrical and mechanical engineers best known for by the general public? As stiffs with no personality and social life." It may have been a sincere quote, but it surely did not advance the cause of women in engineering and simply does not ring true.

RALPH W. WYNDRUM JR.
Fair Haven, N.J.

I feel your panel missed some of the main reasons why it's a challenge to get girls interested in engineering. It is my understanding that most female high school students prefer the medical and law fields over engineering because of the pay and social status. Although females are underrepresented in engineering, the gap is even greater at the supervisory and management levels. There remains a glass ceiling that few break.

Female students often ask me why they should choose a career that requires additional training, education, and certification— such as becoming a registered professional engineer—when the pay scale is greater in other fields for the same effort. And they're not even aware of the inflexible work schedule and lack of a family-friendly environment at most companies.

HEATHER R. EASON
Moncks Corner, S.C.

I enjoyed the article and agree that a better campaign for how engineers affect peoples' lives would likely help more women become interested. I agree that negative stereotyping is pervasive in our culture, but it is not absolutely universal. Some examples of engineers who were also heroes are MacGyver and the Barney Collier character in "Mission: Impossible." However, Hollywood has stacked up hundreds of shallow characterizations of smart people as social misfits. But most of us in engineering are sufficiently secure that those negative portrayals don't really affect us.

ROBERT A. MUIR
Tucson

SUSTAINABLE FORESTRY INITIATIVE
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Breaking Down Economic Barriers to Membership

DIVERSITY IS a hallmark and strength of IEEE. It is shown in our range of activities, from publishing and conferences to standards development and education. It is also evident in our hundreds of technical interests represented by our 45 societies and technical councils and their 1952 chapters.

But another type of diversity is key to the vitality and future of IEEE: geographic diversity. Our members now reside in 160 countries. And last year, more than 80 000 new members joined our ranks. Couple that number with those who renewed their memberships, and the total membership grew to a record of nearly 400 000. Although we're a U.S.–based organization, our transnational spectrum shines through, with 43 percent of members living in countries outside North America. And that percentage has been increasing for many years.

Having members from as many countries as possible can affect the other areas of needed diversity in IEEE. Women, for example, make up 10 percent of membership. With an expanded pool of prospective members worldwide, our IEEE Women in Engineering affinity groups, along with other recruiting efforts, can help bring more women into the fold.

One way to promote such diversity in our membership and thus sustain our success as a leader among technical professional societies worldwide is to make sure that we don't present barriers to prospective members. For those engineers and technical professionals in countries where salary levels are low compared with other countries, the cost of membership is one such obstacle.

Many more individuals in those countries would join IEEE, and many more existing members would renew, if not for the cost. IEEE dues are comparable to those of many other professional associations and sometimes even lower. However, that's no consolation to engineers and others who can't afford the dues. In some cases, the membership fee represents a significant portion of their income.

E-MEMBERSHIP
As a result of economic realities and to expand our diversity, IEEE will offer for the 2011 renewal year an electronic-only membership at a reduced rate. The e-membership will be available to those living in a country with a per capita gross domestic product of less than US $15 000. There are 124 countries that fall into this category. (Please see related item on p. 4.)

> For engineers and technical professionals in countries where salary levels are low, the cost of membership is an obstacle

In developing e-membership, a financial analysis was done by IEEE to see whether the reduced fees would have an adverse affect on IEEE finances as a whole. The study showed that there will be limited negative impact. In fact, the design of the membership category, which will account for less than 1 percent of overall revenue, helps mitigate any losses and over the long term is actually projected to add to the bottom line. Furthermore, research on alternate membership models suggests that, because of the lower price point for IEEE membership, members in the affected countries will be more likely to join or increase their participation in society activities and use more products and services.

The new membership offering represents a minor extension of the reduced fees already available to life members, student members, recent graduates, retired people, the unemployed, and those who meet the current minimum-income threshold. We have operated with those categories, which now account for about 40 percent of our membership, for several decades. I believe they have helped add to our diversity by making it possible for more engineers and other technical professionals to join IEEE.

An ancillary benefit to IEEE for offering the e-membership is that we increase the pool of members who could serve as volunteers. Member volunteers number in the tens of thousands, with many filling multiple roles. We have a constant need to refresh our volunteer ranks to keep IEEE vibrant and growing. We also need younger volunteers who can learn from the more experienced ones and bring fresh perspectives to bear on a range of activities and issues within the organization.

IEEE membership is valuable because you help make it that way with your continued support of our programs and activities and your loyalty. While we help make membership available to more individuals, I ask you to encourage your fellow technical professionals to consider the benefits of joining you, me, and others around the world in achieving our mission to advance technology for the benefit of humanity.

Pedro Ray
IEEE President and CEO

BENEFITS

PRODUCTS & SERVICES

PRODUCTS & SERVICES
SOCIETY SPOTLIGHTS
BOOKS
CONFERENCES

Providing Access to Published Research, Faster

BY KATHY KOWALENKO

BY OFFERING online-only publications and electronic versions of new content in the IEEE Xplore digital library, societies are speeding up access to the latest research. The era in which it could take months to deliver research results is ending.

In the past two years, several peer-reviewed online-only journals have been launched on IEEE Xplore, and more journals are posting their articles in the digital library before they appear in print.

ON THE WEB
The newest of the online-only journals, *IEEE Magnetics Letters*, was launched this year by the IEEE Magnetics Society. The publication covers the physics and engineering of magnetism and magnetic materials, applied magnetics, biomagnetics, magnetoelectronics, and spin electronics. The journal publishes articles as soon as authors approve page proofs; the articles are posted in a fully citable format.

They are limited to four pages and can include color graphics.

"We found that many authors can effectively communicate important new information in four pages," says editor Ron Goldfarb, an IEEE Fellow. "And busy reviewers are more agreeable to reviewing short pieces."

A new citation style, by author instead of by number, means readers don't have to keep jumping between the text and the reference list. The references also include clickable links to cited material.

Written in a typeface that makes for easier reading online, *IEEE Magnetics Letters* also supports hybrid open access, which means it publishes both paid and open-access articles. For a fee, authors may make their articles freely available to all, including nonsubscribers. Such articles are identified as open access.

PHOTONICS AND COMPUTING
The bimonthly *IEEE Photonics Journal* covers wavelength sources from X-ray to terahertz, photon-

ics materials, nanophotonics, and biophotonics. The IEEE Photonics Society launched the publication last June as IEEE's first hybrid open-access journal.

There were many reasons to offer the journal online, according to its editor, IEEE Fellow Carmen Menoni. One is the faster turnaround time from the date an author submits an article to when it is published online—an average of about 5 weeks, compared with the 10 weeks it takes to get an article into print. Another benefit is that authors are not constrained by space limits. "They can incorporate larger figures, color graphics, and multimedia files," Menoni says.

Authors can also include their biographies or a list of their conference papers related to the topic that are linked to the paper in IEEE Xplore. The papers have a new look: They are printed in a single column for easy reading on a screen and have a distinct cover with a colorful graphic.

Menoni stresses that the peer-review process has not been com-

promised. "We offer the same high standard of editorial quality and fair-minded rigorous review characteristic of all IEEE journals," she says.

Another new online-only publication is *IEEE Transactions on Affective Computing*, published by the IEEE Computer Society. It will be launched in July and will include papers on the design of systems that can recognize, interpret, and simulate human emotions and related affective phenomena. It is to cover how affective sensing and simulation techniques can influence the understanding of human affective processes, psychology, and behavior as they relate to affective computing, behavior generation, and user interaction. The journal will come out again in December and quarterly thereafter.

The IEEE Computer Society already publishes two other online-only journals: *IEEE Transactions on Services Computing* and *IEEE Transactions on Learning Technologies*.

Services Computing focuses on research on the algorithmic, mathematical, statistical, and computational methods that are central to services computing, which includes service-oriented architecture, Web services, business process integration, and services operations and management. *Learning Technologies* covers research on such topics as innovative online learning systems, educational software applications and games, and simulation systems for education and training. The publication model for *Learning Technologies* is known as delayed open access, which makes papers available for free one year after they've been published.

EARLY ACCESS
All but two of IEEE's 148 transactions, journals, and magazines now post an advance electronic version of their new content in IEEE Xplore. At last count, more than 5500 articles were posted and identified as early access.

There are two ways to find early-access articles in the digital library. One is by browsing to a specific journal or magazine's publication page and clicking the Early Access "View Articles" label. The other way is to conduct an advanced search and select the Early Access option under the Content Type tab. ∎

IEEE Geoscience and Remote Sensing Society
To join: http://www.grss-ieee.org

The society's premier conference, the IEEE International Geoscience and Remote Sensing Symposium, will celebrate its 30th anniversary from 25 to 30 July with a look to the future. The symposium's plenary session will highlight the emerging field of community remote sensing, which leverages information gathered through social networks and by individual volunteers who perform tasks involving observation, measurement, and computation. This data, by augmenting traditional satellite and aircraft remote-sensing systems, will help scientists understand the mechanisms of climate change, enhance human prosperity, and respond to natural disasters.

IEEE Nuclear and Plasma Sciences Society
To join: http://ewh.ieee.org/ soc/nps

Thanks to a successful membership recruitment campaign, this society had one of the biggest jumps in membership last year, a 10.9 percent increase over 2008. The expansion was due to a successful membership recruitment campaign.

The broad range of interests NPSS covers includes radiation instrumentation and effects, medical imaging, plasma science, fusion technology, pulsed-power systems, particle accelerator science and technology, and computer applications to nuclear and plasma sciences. The latest research is published in the society's three journals: *IEEE Transactions on Nuclear Science*, *IEEE Transactions on Plasma Science*, and *IEEE Transactions on Medical Imaging*, the last of which is published in cooperation with several other societies. The society also sponsors four annual conferences and sponsors or cosponsors numerous other conferences in the nuclear and plasma sciences.

IEEE Engineering in Medicine and Biology Society
To join: http://www.embs.org

A series of forums the society launched in May addresses the challenges facing the biomedical engineering field. The forums review the progress made during the past decade and identify challenges facing related disciplines in the next 10 years. One forum addressed neuroengineering, an emerging field that translates research into neurotechnologies that could lead to enhanced patient care. Topics included decoding brain activity, repairing or reversing brain damage, and the brain as an information processor.

The society teamed with the American Medical Association to hold the first-ever joint conference on medical technology devoted to individualized health care, which took place in March in Washington, D.C. Individualized health care is motivated by the observation that medical interventions have to be tailored to the physiology of each individual. Interest in the topic is being driven by the increased use of genetic information in making clinical decisions and of electronic patient records, by the creation of national health registries, and by novel technologies for remote data capture of clinical information.

Chalk Up Another Member Benefit: Free E-Books

Worldwide sales of e-books are expected to jump from US $323 million in 2008 to nearly $9 billion in 2013, according to a forecast by the market research firm In-Stat. Taking note of the digital books' popularity, IEEE is now offering members a collection of 220 IEEE e-books for free through the IEEE Xplore digital library. The topics of these IEEE eBook Classics include power engineering, electromagnetics, circuits, computing, robotics, photonics, and biomedical engineering. The books are broken down by individual chapters rather than as full cover-to-cover text and can be read on any device that displays PDF files.

"We're very pleased to offer this to members," says 2009 IEEE president John Vig, who spearheaded the effort to make the books available and who also hopes the benefit will attract new members.

With the debut of IEEE Xplore 3.0 in February, a joint Wiley-IEEE Press collection of more than 400 e-books is also being offered in a subscription package sold to institutional libraries. The new IEEE eBook Classics were chosen from among IEEE-copyright books in that collection that are at least three years old. Plans call for the collection to be enlarged in the future.

FINDING A BOOK

To find the e-books, log in to IEEE Xplore using your IEEE Web account. Click on Books in the left-hand Browse navigation menu. Next, click on the Classics tab to browse the titles. Once you find a book you're interested in, click on the title to go to its home page, which contains an abstract, bibliographic information, a table of contents, and an image of the cover. Chapter links take you to the part of the book you want to read. In addition, from the home page you can search by subject or keyword to find information within the book.

—Anna Bogdanowicz

Here's a sample of available titles:

Maintaining Mission Critical Systems in a 24/7 Environment
### By Peter M. Curtis (March 2007)
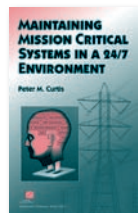
With the growth of e-commerce and 24/7 operations, maintaining mission-critical facilities is a booming business. This book offers a reference and training guide for how to operate, manage, and maintain all types of key equipment. Also covered are reliability and availability requirements for the electrical and mechanical systems needed to maintain continuous operation and to minimize downtime.

Introduction to Evolvable Hardware: A Practical Guide for Designing Self-Adaptive Systems
### By Garrison W. Greenwood and Andrew M. Tyrrell (October 2006)
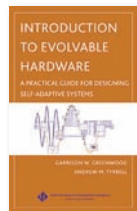
The authors introduce the concept of evolvable hardware, which can change its architecture and behavior dynamically based on interaction with its environment. The authors cover everything from the fundamentals of evolutionary computation to the intricacies of fault-tolerant systems.

## Modern Industrial Automation Software Design
By Lingfeng Wang and Kay Chen Tan (February 2006)
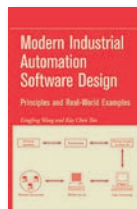
Developing industrial automation software increasingly requires the integration of expertise across many disciplines, including software engineering, data communications, and resource management. The book explores software development using cutting-edge technologies.

## Optical WDM Networks: Concepts and Design Principles
By Jun Zheng and Hussein T. Mouftah (August 2004)
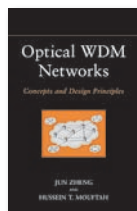
Wavelength division multiplexing has emerged as an efficient technology for exploiting the huge bandwidth capacity inherent in optical fibers. The book introduces fundamental WDM concepts and design principles and covers technologies that address design issues. Topics include network architectures, routing and wavelength assignment, virtual topology configuration and reconfiguration, distributed lightpath control, and optical-layer protection and restoration.

Principles of Electric Machines With Power Electronic Applications, 2nd Ed.
By Mohamed E. El-Hawary (June 2002)
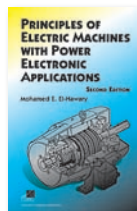
All machines have power requirements, and finding the right balance of cost and performance can be a challenge. This book is an introduction to the principles of electric machines, power electronics, and adjustable-speed drives and covers the fundamental structure of electric power systems.

CHARLES KNOX/ISTOCKPHOTO

IEEE Frontiers in Education Conference

Arlington, Va., 27–30 October

Papers, panel discussions, and workshops cover a variety of topics in preuniversity engineering education. Sessions address creative ways to teach ethics; distance learning methods, technologies, and assessments; and technology in the classroom.
SPONSOR: IEEE Computer Society
VISIT: http://www.fie-conference.org/fie2010

IEEE International Conference on Mechatronics and Automation

Xian, China
4–7 August

Workshops, tutorials, technical sessions, and plenary talks cover robotics, biomedical and rehabilitation engineering, control systems and modeling, nano- and microsystems, sensor networks, and related topics.
SPONSOR: IEEE Robotics and Automation Society
VISIT: http://webdocs.cs.ualberta.ca/~icma2010

IEEE Conference on Emerging Technologies and Factory Automation

Bilbao, Spain
13–16 September

Topics include information technology in automation, industrial communication systems, real-time and networked embedded systems, automated manufacturing systems, and industrial control, with emphasis on process, equipment, and intelligent and supervisory control. Also on the agenda are intelligence and heuristics in automation, as well as intelligent robots and systems.
SPONSOR: IEEE Industrial Electronics Society
VISIT: http://www.etfa2010.org

IEEE International Conference on Systems, Man, and Cybernetics

Istanbul
10–13 October

With a focus on advances in systems science and engineering, human-machine systems, and cybernetics, topics include consumer and industrial applications, discrete event systems, and Petri nets. Sessions include smart metering, intelligent green production systems, brain-based information communications, interactive and digital media, bioinformatics, evolutionary computation, and heuristic algorithms.
SPONSOR: IEEE Systems, Man, and Cybernetics Society
VISIT: http://www.smc2010.org

Else Shepherd

Breaking Into the Boys' Club

This pioneering power engineer transcended social prejudices

BY SUSAN KARLIN

DESCRIBING THE negative attitude in Australia toward female engineers in the late 1960s, IEEE Member Else Shepherd recalls a dinner party where, upon finding out that she was an electrical engineer, the man sitting next to her blurted out, "Aren't you sorry for your husband?" The rude diner's misguided sympathy didn't deter Shepherd, who broke gender barriers and transcended social prejudices to become a pioneering engineer in the manufacturing and power sectors and academia.

She helped introduce computers to the country's sugar-processing industry and cofounded two high-tech start-ups. She is now chair of Powerlink Queensland, the state's transmission utility company, and a recently retired board member of the International Electrotechnical Commission, which sets global electrotechnology standards.

Along the way, she collected 14 awards, including the 2009 University of Queensland Alumnus of the Year, bestowed in November, for her contributions to engineering.

Still, she says she'd exchange her suit for a lab coat any day: "Being on a board and having the ability to be influential haven't pleased me as much as working as an engineer and developing new devices."

Her favorite career memories date to when she was developing cutting-edge technology—such as her first job as a research engineer for the Sugar Research Institute, in Mackay, Queensland. There she helped streamline the transportation system bringing sugarcane into the mills so that less of the cane arrived stale.

"We introduced the mills to the concept of using computers for transportation control," she says. "This was in the late '60s. We had a computer the size of a room with only 16K of memory, but it was enough to make a difference in the scheduling system. It saved the mills a lot of money." The work earned Shepherd her first award: the 1972 President's Medal from the Australian Society of Sugar Cane Technologists.

BREAKING BOUNDARIES

Shepherd emigrated from South Africa with her family at age 12. As a child she was always drawn to math and physics. "In those days, if you were a girl interested in a career involving science, you either had to be really brilliant or become a teacher," she says. "My father thought I should go into medicine, but I wanted a profession that used math and physics."

Shepherd and another student were the first women to earn engineering degrees from the University of Queensland, in 1965.

Luckily, she didn't face bias at the Sugar Research Institute. "In the sugar industry, I had skills the men didn't have, so they were pleased to have me there," she says. But not everyone was so understanding.

"In those days, society deemed engineering an unacceptable line of work for women," she says. "At conferences, the men wouldn't eat lunch with me, and outside of work they had to be careful not to be too friendly with me, because I was perceived as a threat to their wives.

"When I told my hairdresser I was an engineer, she could hardly bear to cut my hair. But I just thought it was funny," she continues. "I enjoyed my work. I had kids and a supportive husband who was happy to have a wife with an interesting job. I just accepted early on that what I was doing was considered weird. But

when I tell those stories today, kids think it's too bizarre for words."

In 1976, she became a manager at Batstone Hendry & Associates, where she oversaw process control systems, and she also began a part-time job, which she continues today, teaching math, physics, process control, electrical circuit theory, and telecommunications at various Queensland universities.

She went on to cofound two Brisbane-based high-tech start-ups: Mesaplexx (formerly Microwave & Materials Designs), a nine-year-old manufacturer of high-temperature superconductors for microwave filters used in mobile telephone systems, and the now-defunct Mosaic Information Technology, which developed digital signal-processing technology for the telecommunications industry in the mid-1980s.

Today, as the first female chair of Powerlink Queensland, Shepherd's duties include overseeing the six-member board of directors. The company builds, operates, and maintains the state's high-voltage electric grid. She also works with the CEO on strategic issues and serves as the company's liaison to the government. Under her 15-year guidance, Powerlink's revenues have grown from US $1.4 billion to nearly $5.4 billion. She has also helped the firm develop a reputation as an early adopter of new technology and cost-effective practices.

Shepherd's next move might be another start-up, one that involves metamaterials, artificially engineered substances containing properties not found in nature. That's if she can squeeze it in among her advisory work with various boards and encouraging the next generation of engineers through lectures and teaching.

"When I give talks to young engineers, I remind them that engineering is such interesting work and to rejoice in having a job that allows them to work on improving the world around them," she says. "Being an engineer really is a privilege." ■

Michael Currin
Road Warrior

IT WAS SEEING the tough guy always get the girl in biker movies that lured IEEE Member Michael Currin to motorcycles. He stayed for the speed and the thrill.

"I started riding as soon as I got a driver's license at 16, and I quickly got hooked," Currin says. "I went through my chopper phase—riding bikes with the long front end, which actually degraded handling and comfort but looked cool."

As he got older, he acquired BMWs (a K11RS and an R80RT), which, he says, are more about performance and comfort. Currin now has six motorcycles.

He is an operations-research systems analyst for the U.S. Army Airborne and Special Operations Test Directorate at Fort Bragg, in North Carolina. More than 35 years after he got on his first bike, he still rides almost every day, including during his 80-kilometer round trip to work.

But these days he's part of a niche group of riders. "I'm a motorcyclist who's evolved into a sidecarist," he says. Currin builds high-performance sidecars, one-wheeled devices that attach to a motorcycle and carry one or two people. The souped-up suspensions and other custom and performance features can run US $18 000 to $20 000.

His younger son, Jake, got him interested in sidecars. Jake was born with cerebral palsy and is unable to use his legs. "I realized he'd never be able to ride on the back of a motorcycle, so I started looking into sidecars," Currin says. "I also built a trailer to haul his wheelchair that rides behind his sidecar. When he was a toddler, I'd take him to school in the sidecar, and the other kids would line up to watch him ride up."

When Currin, with Jake, had trouble keeping up during motorcycle rallies—at which enthusiasts gather and ride in groups—he modernized his original sidecar with an improved suspension that can handle car tires, rather than motorcycle tires. "It puts more rubber on the road for better traction and stability, as well as getting around corners faster," he explains.

The rest of his family is involved in his hobby. Currin built another sidecar for his older son, Cody, and a motorcycle trike—a three-wheeled motorcycle—for his wife.

But the family-friendly bikes are a lot tougher than they look, he says: "I see 60-year-old motorcyclists with sidecars outrunning the kids on sport bikes."

—*Susan Karlin*

PASSION Motorcycling
PROFESSION Systems analyst
HOMETOWN Erwin, N.C.
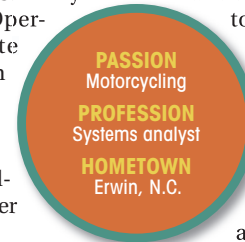
Michael Hyland
Resilient Referee

NOT EVEN a serious injury could keep IEEE Member Michael Hyland from his lifetime love of lacrosse.

It took several weeks for him to recover from a cracked neck vertebra he suffered in college while playing the game. But today, almost 30 years later, he's more active in lacrosse than ever.

When he's not busy as vice president of engineering services for the American Public Power Association, in Washington, D.C., he's either playing, coaching, or officiating the sport. He's a National Collegiate Athletic Association Lacrosse official and one of 10 referees chosen to officiate at the 2010 World Lacrosse Championships, in Manchester, England, in July.

In lacrosse, players run down a field, passing a small rubber ball to one another using long-handled racquets with loose mesh netting at one end in which they catch the ball. The players try to throw the ball into the other team's guarded goal.

"Lacrosse is many sports rolled into one. You hit your opponents like in football, run as you do in soccer, and have formations like those in ice hockey and basketball," says Hyland, who has been playing lacrosse since he was 12. "It's a very fast game—and it's not for wussies."

That point was driven home hard when Hyland was a freshman on a lacrosse scholarship at the U.S. Air Force Academy, in Colorado Springs, Colo., in 1982. During a game early in the season, a blow to his neck put him in the hospital for six weeks. The injury curtailed his aggressive play—which ruled out college teams. So Hyland decided instead to study electrical engineering at Drexel University in his hometown, Philadelphia.

"My father worked for Westinghouse and wanted one of his seven sons to go into engineering," he says. "I was very good at math and science, so I became the one."

But he never completely lost the lacrosse bug. After graduating in 1988 and forging a career at electric utilities, he still played on the occasional club team. He upped his coaching efforts after another lacrosse-related surgery in 1989 made him more realistic "about not throwing my body into people anymore."

Even his coaching slowed. After Hyland's second child was born in 1994, he began coaching fewer hours and found another activity that didn't require as much time: officiating. "It was only twice a week, and it fit into my schedule better," he says. In 1997, he started refereeing college games.

Today, he coaches at his local high school and officiates at college games in Delaware, Maryland, North Carolina, Virginia, and Washington, D.C.

PASSION Lacrosse
PROFESSION Utility executive
HOMETOWN Huntingtown, Md.

Hyland as a referee has found some similarities between engineering and lacrosse. "Both have precise rules, and you're required to make tough decisions that aren't always popular," he says. "In a stadium of 20 000 people, no matter what call you make, 50 percent are gonna be mad at you. But your job is to make the right call."

—*S.K.*
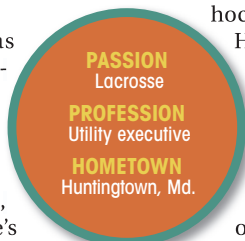
If you have an interesting hobby you'd like to share, e-mail the editors: institute@ieee.org.

FELLOW
KON MAX WONG

Wong has received a Humboldt Research Award from the Alexander von Humboldt Foundation for his work in electrical and computer engineering. The nonprofit German foundation, which aims to improve international cooperation among technologists working on research projects, grants up to 100 awards annually. Wong plans to do research at a German institution. His US $90 000 award is to be presented by German president Horst Köhler.

For almost 30 years, Wong has been a professor of electrical and computer engineering at McMaster University, in Hamilton, Ont., Canada. He holds a research chair in signal processing at the university.

His areas of interest include signal detection and estimation, sensor array processing, adaptive filtering, communications theory, optimal design of transmitters and receivers, multiple-input and multiple-output communications, and biomedical signal processing. His university research group is developing high-performance signal-processing algorithms for communications technologies, including wire-line, cellular, and satellite telephony; multicarrier communications; radar and antenna arrays; and target identification and tracking.

Wong is a member of the IEEE Information Theory and Signal Processing societies.

SENIOR MEMBER
WILLIAM L. JONES

Jones was presented with the Lifetime Achievement Award in Aerospace from the National Society of Black Engineers. He was cited for his technical excellence, leadership, and contributions to the aerospace engineering field.

Jones is a senior staff scientist and subproject manager of the Microelectronics Product Center at Northrop Grumman's aerospace systems department in Los Angeles. He oversees the development of monolithic microwave integrated circuits for flight payloads and is the MMIC subproject manager for Northrop Grumman's advanced extremely high-frequency program. That program is developing the U.S. military's newest strategic and tactical communications relay system.

GRADUATE STUDENT MEMBER
SANNA GASPARD

Gaspard was chosen by the U.S. National Engineers Week Foundation as one of its 13 New Faces of Engineering for 2010. She was recognized for her innovative research on a device to improve the health and survival rate of newborns. The National Engineers Week Foundation is a coalition of companies, government agencies, and engineering associations, including IEEE-USA. Its New Faces program highlights the vitality, diversity, and contributions of engineers under 30.

Gaspard is a graduate student and researcher at Carnegie Mellon University, in Pittsburgh. There, she developed the neonatal automated physiotherapy device, which helps keep newborns healthy by massaging them. Studies have found that massage promotes healthy development of infants. To commercialize the new technology, Gaspard recently founded TLneoCare, a pediatric-care biotech company in Pittsburgh.

Gaspard is a member of the IEEE Instrumentation and Measurement, Circuits and Systems, and Engineering in Medicine and Biology societies, as well as IEEE Women in Engineering.

IN MEMORIAM

M. TURHAN TANER
PIONEERING GEOPHYSICIST
MEMBER GRADE: Life Member
AGE: 82
DIED: 6 February

M. Turhan Taner was a geophysicist who pioneered seismic methods used in the collection of geophysical data that led to breakthroughs in the exploration and development of oil and gas fields.

In 1964, Taner helped found Seiscom Delta, a geophysical services company in Houston that explores remote areas of the United States for oil and gas. He went on to serve as the company's director of research, senior vice president for technology, and chairman. While there, he devised an algorithm to measure the coherence of reflection events along hyperbolic travel-time trajectories. This seismic method is used today to derive stacking velocity fields along seismic traverses.

Taner left Seiscom Delta in 1980 to establish Seismic Research Corp., a developer of geophysical software, also in Houston. As chairman and CEO, he oversaw work on advanced seismic data-processing techniques. The company merged with Petrosoft and Discovery Bay in 1998 to create Rock Solid Images, also in Houston. Taner became senior vice president and chief geophysicist of the company, which develops technology for computing geophysical signatures between wells.

Taner was also an adjunct professor of geology and geophysics at Rice University, Houston.

He received a diplôme engineer in 1950 from the Technical University of Istanbul, which awarded him an honorary Ph.D. in 1991.

Three employees of Tesla Motors, in Palo Alto, Calif., two of whom were IEEE members, died in the crash of a small plane in February.

DOUG BOURN
SENIOR ELECTRICAL ENGINEER
MEMBER GRADE: Member
AGE: 56
DIED: 17 February

Doug Bourn was working on digital logic design, analog circuit design, and test fixture design and construction. He was piloting the plane, which flew into electrical lines during a morning takeoff and crashed.

Bourn joined Tesla in 2005 as a senior electrical engineer. He helped develop and test the power electronics of the Tesla Roadster, the company's showpiece all-electric car.

Before joining the company, he was a senior electrical engineer at Ideo, the product design and development company in Palo Alto that was behind the original Apple mouse and the Palm Treo. He worked on a variety of consumer products and medical electronic devices.

Bourn received a bachelor's degree in 1973 in electrical engineering from Stanford University. He also held a degree from Michigan Technological University, in Houghton.

BRIAN FINN
SENIOR MANAGER
MEMBER GRADE: Member
AGE: 42
DIED: 17 February

Brian Finn was Tesla's senior manager of interactive electronics.

He joined the company in 2008, and his work focused on multimodal driver information and human-machine interaction for connected multimedia applications. At the time of his death, he and his team were working on a computerized dashboard system featuring a touch screen for Tesla's Model S sedan.

Finn began his career as a researcher in 1991 at Fermi National Accelerator Lab, in Batavia, Ill., where he focused on high-energy physics. He left in 1992 to go to work for Nelson Industries of Stoughton, Wis., which produces air and liquid filtration products. There, he helped develop an onboard vehicular communications system, for which he earned his first patent. He left in 2001 to join Volkswagen of America, in Palo Alto, where he managed a research team in the Electronics Research Lab.

Finn received a bachelor's degree in physics and a master's degree in electrical engineering from Northern Illinois University, in DeKalb, in 1990 and 1992, respectively.

Nominations Needed

Candidates are being sought for the 2012 IEEE Technical Field Awards. Nominations are due by 31 January 2011.

IEEE CLEDO BRUNETTI AWARD
For outstanding contributions to nanotechnology and miniaturization in the electronics arts.
SPONSOR: Brunetti Bequest

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

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

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

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

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

IEEE HERMAN HALPERIN ELECTRIC TRANSMISSION AND DISTRIBUTION AWARD
For outstanding contributions to electric transmission and distribution.
SPONSORS: Robert and Ruth Halperin Foundation, in memory of the late Herman and Edna Halperin, and IEEE Power & Energy Society

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

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

IEEE REYNOLD B. JOHNSON INFORMATION STORAGE SYSTEMS AWARD
For outstanding contributions to information storage systems, with emphasis on computer storage systems.
SPONSOR: IEEE Reynold B. Johnson Information Storage Systems Award Fund

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

IEEE JOSEPH F. KEITHLEY AWARD IN INSTRUMENTATION AND MEASUREMENT
For outstanding contributions in electrical measurements.
SPONSOR: Keithley Instruments

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

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

IEEE WILLIAM E. NEWELL POWER ELECTRONICS AWARD
For outstanding contribution(s) to the advancement of power electronics.
SPONSOR: IEEE Power Electronics Society

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

IEEE DONALD O. PEDERSON AWARD IN SOLID-STATE CIRCUITS
For outstanding contributions to solid-state circuits.
SPONSOR: IEEE Solid-State Circuits Society

IEEE FREDERIK PHILIPS AWARD
For outstanding accomplishments in the management of research and development resulting in effective innovation in the electrical and electronics industry.
SPONSOR: Philips Electronics N.V.

IEEE PHOTONICS AWARD
For outstanding achievement(s) in photonics.
SPONSOR: IEEE Photonics Society

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

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

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

IEEE FRANK ROSENBLATT AWARD
For outstanding contribution(s) to the advancement of the design, practice, techniques, or theory in biologically and linguistically motivated computational paradigms, including but not limited to neural networks, connectionist systems, evolutionary computation, fuzzy systems, and hybrid intelligent systems in which the paradigms are contained.
SPONSOR: IEEE Computational Intelligence Society

IEEE DAVID SARNOFF AWARD
For exceptional contributions to electronics.
SPONSOR: Sarnoff Corp.

IEEE MARIE SKLODOWSKA-CURIE AWARD
For outstanding contributions to the field of nuclear and plasma sciences and engineering.
SPONSOR: IEEE Nuclear Plasma and Sciences Society

IEEE CHARLES PROTEUS STEINMETZ AWARD
For exceptional contributions to the development and/or advancement of standards in electrical and electronics engineering.
SPONSOR: IEEE Standards Association

IEEE ERIC E. SUMNER AWARD
For outstanding contributions to communications technology.
SPONSOR: Alcatel-Lucent Bell Labs

IEEE NIKOLA TESLA AWARD
For outstanding contributions to the generation and utilization of electric power.
SPONSORS: The Grainger Foundation and IEEE Power & Energy Society

IEEE KIYO TOMIYASU AWARD
For outstanding early to mid-career contributions to technologies holding the promise of innovative applications.
SPONSORS: Dr. Kiyo Tomiyasu, IEEE Geoscience and Remote Sensing Society, Microwave Theory and Techniques Society, and KDDI R&D Laboratories

TEACHING AWARDS

IEEE LEON K. KIRCHMAYER GRADUATE TEACHING AWARD
For inspirational teaching of graduate students in the IEEE fields of interest.
SPONSOR: Leon K. Kirchmayer Memorial Fund

IEEE UNDERGRADUATE TEACHING AWARD
For inspirational teaching of undergraduate students in the IEEE fields of interest.
SPONSOR: IEEE Education Society

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